WEST AMERICAN SHELLS

JOSIAH KEEP

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THE GREEN ABALONE
Haliotis fulgens (*), page 252

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West American Shells

A DESCRIPTION IN FAMILIAR TERMS OF THE PRINCIPAL MARINE, FRESH WATER AND LAND MOLLUSKS OF THE UNITED STATES FOUND WEST OF THE ROCKY MOUNTAINS, INCLUDING THOSE OF BRITISH COLUMBIA AND ALASKA

FULLY ILLUSTRATED

Also a Classified Reference List of the species and varieties known to exist within the above limits

By

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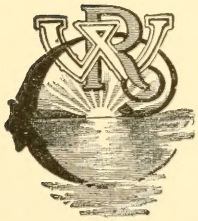

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PREFACE

The latter part of the nineteenth century was an important period for the science of Conchology. While many private collectors were gathering specimens of all kinds, and incidentally making many new discoveries, the universities were establishing seaside laboratories, the Government was sending out exploring vessels, the learned societies were putting forth publications, and especially the National Museum at Washington was issuing very valuable bulletins, embodying the conclusions of its painstaking investigators.

This activity has resulted in the accumulation of much new material, and incidentally the changing of many old names. The latter work is an ungracious piece of business at best, and has seldom been indulged in wantonly. But new views on the subject of classification, and an enlarged knowledge of the fossil progenitors of existing species, have compelled the readjustment of what before seemed settled. It is comparatively easy, when collecting in a small field, to separate the specimens into fixed and definite groups; but as one's observations become extended, the varieties multiply, and increasing knowledge of both facts and records causes embarrassment. The necessary changes, however, even of familiar names, must not be too deeply regretted, for they indicate a real advance in our conception of the great plan of nature.

The kind reception given to my previous efforts to popularize the study of mollusks, together with the

exhaustion of the edition of "West Coast Shells," has led to the preparation of this volume, in the hope that it may have a still more extended usefulness than its predecessor. It is not a mere revision of the former book, but it has been very largely rewritten, while the arrangement is wholly different and more in accord with modern views. A great number of new species have been noted, and more than a hundred new engravings have been added. While the unsatisfactory descriptions of some minute shells have been omitted, an extended Check-List has been added, which gives a fairly complete classified table of the valid species existing on this coast, including references to standard scientific works in which these species are mentioned or described. While the body of the book is designed for less advanced students and collectors, it is hoped that the "List" may prove helpful not to them only, but also to scientists in general. In giving measurements, both the common and the metric systems have been employed. Remember that a millimeter (mm.) is nearly equal to one twenty-fifth ($^1/_{25}$) of an inch.

In order to adapt this book to readers of "West Coast Shells," the old name of a species has been retained in parentheses, whenever a change has been made. A "common name" has also been given to each species described, usually a more or less free translation of the accepted Latin name.

As might be expected, much difficulty has sometimes been experienced in deciding between the claims of rival synonyms, and it is not to be hoped that all will accept the author's conclusions; an honest endeavor, however, has been made to select the name which has been adopted by the best authorities.

The grateful task remains to return thanks and ac-

knowledgments to those who have assisted me in various ways. Information found in volumes of "The Nautilus," "The Manual of Conchology," and other scientific books, has been freely used, and especially that contained in the "Bulletins of the United States National Museum." Especial acknowledgments are due to the authorities of the latter institution, for permission to copy engravings of shells — a permission which has been freely used. The number placed under each one of such engravings is followed by an asterisk (*), to denote its origin. The "Catalogue of Shells," by the late Dr. J. G. Cooper, should also be mentioned, as helpful for deciding localities.

Sincere thanks are returned to Dr. William H. Dall and his co-laborers in the Smithsonian Institution for many helpful suggestions; to Professor William J. Raymond, of the University of California, for the list of Chitons, and for other assistance; to Mr. and Mrs. T. S. Oldroyd, of Long Beach, Cal., for the opportunity to examine their remarkable collection of shells; to Ralph Arnold, Ph. D., of Stanford University, for assistance derived from his recent valuable publication on the fossil shells of San Pedro; also to Dr. R. E. C. Stearns, Rev. E. H. Ashmun, Mr. Henry Hemphill, and many others, who in various ways have given encouragement and assistance.

In conclusion, I would express my growing appreciation of the magnitude of the field which I have attempted to cover, and my hope that this work may be accepted by students as a helpful assistance towards obtaining a complete knowledge of West American Shells.

JOSIAH KEEP.

Mills College, California,
July 11, 1904.

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SUGGESTIONS FOR BEGINNERS

Whenever you collect shells it is well either to make a record or write a label stating where and when they were found. There are a number of things which you will wish to learn about them, three of which are as follows: their names, their structure, and the habits of the animals which constructed them. This book is designed to enable you to obtain the names, so that you may be able to speak of your shells intelligently, and to suggest a proper mode of classification. It also gives hints concerning the structure and markings of the shells, and tells you some things about the habits of the mollusks to which they originally belonged.

Very much, however, will depend upon your spirit of investigation. Never be satisfied to simply know the name of a shell, but go on to learn all you can about the life of its former occupant. The more familiar you become with this book, the easier you will find the work of naming shells. Note the general plan and order of the chapters. Study the pictures carefully, and you will soon learn the probable place to turn for the description of an unknown shell. Consult the "List" freely, and put the number of the species on your labels. This will help in classification. If you have opportunity, look up the references and consult other authorities.

WEST AMERICAN SHELLS

CHAPTER I

LAMP-SHELLS AND THEIR ALLIES

We begin our description of the West American shells by inviting your attention to a class that very properly carries our thoughts far back into the dim ages of the past. Long before the first man that ever stood upon the seashore reached down to the sand and took up a shell, long before the sand upon which he was standing had been ground up from the solid rock by the great mill of the ocean, long before even the rocks themselves had been raised above the surface of the primæval sea, in those ancient days when a broad ocean spread over the place where continents are now dotted by human abodes, and corals were building reefs where men are now building cities, — then, in countless millions the Brachiopods lived, multiplied, and died, leaving their shells to be formed into limestone or to be preserved in the rocks, until many ages later they should be gathered as rare fossils for the naturalist's cabinet.

As time went on the brachiopods gradually decreased in numbers, other creatures taking their places, until at present they are rarely taken alive, though in some of the colder parts of the ocean and in tolerably deep water they are sometimes found in considerable numbers.

By most naturalists the brachiopods are now classed with the worms, or at least with the molluscoidea, instead of with the mollusks, for in many respects they differ from the ordinary clams. In the first place their shells consist of upper and under valves, instead of right and left as in the clam, and the creature firmly attaches itself to some object by a pedicle which passes through an opening in the beak of one of the shells. On this account they have long been known as Lamp-shells, since the curved valve resembles the bowl of an ancient lamp, the hole through its beak being the opening for the wick.

Internally the creature differs from the clam still more than it does externally, for it has no ribbon-like gills, like the oyster, but instead it can throw out a pair of long arms, which serve both as blood purifiers and food gatherers. These arms being also somewhat suggestive of legs gave rise to the old name Brachiopod, meaning arm-foot. Internally there are various hard supports in some of the shells, which seem to serve as brackets on which the long arms may rest when not in active use.

Figure 1 is an enlarged picture of the Snake's-head Lamp-shell, *Terebratulina cáput-serpéntis,* Linn. (Terebratula unguiculus), West Coast Shells, p. 214. The first name does not mean Lamp-shell, but literally it signifies the little-shell-in-which-a-hole-has-been-bored. You can see

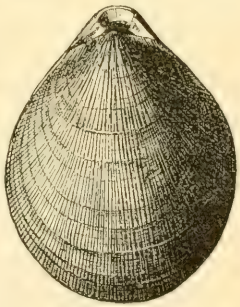


Fig. 1, x $\frac{4}{3}$ (*)

*By permission, from Bulletin of United States National Museum.

the hole at the upper end, and can readily imagine that it was made for the wick of a lamp, as has been explained. This species is found in northern waters, both of the Atlantic and the Pacific; it also occurs as a fossil in the rocks of Europe. It is not a common shell, but is chiefly obtained by dredging, sometimes from a depth of half a mile. Externally the shell is ash colored. The figure is magnified one-third, as is indicated by its fraction. Similar fractions will occur throughout the book, when the figures are not of the natural size.

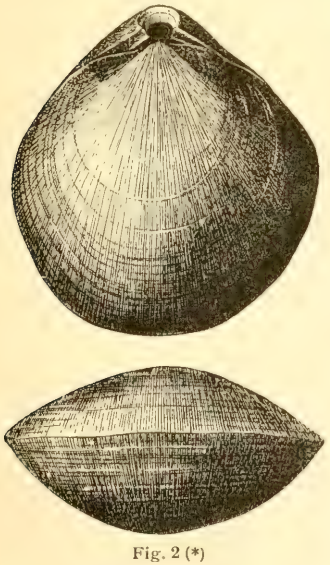


Fig. 2 (⅓)

Figure 2 represents the Kii Lamp-shell, *Terebratulina kiiénsis,* Dall & Pilsbry. It is so called because it was named from specimens gathered on the coast of the province of Kii, in Japan. It is a large shell, the picture being about the natural size of a mature specimen. The lower figure gives an end view, showing its plumpness. This species also lives in the sea where the water is deep and cold, and has a very wide range, extending from off Santa Cruz, Cal., up past Alaska and down to the Philippine Islands. The color is waxen white, with stains of brown.

Platídea anemínoídes, Sacchi, the Little Lamp-shell, is not much larger than the head of a good sized pin. It is quite flat, without distinct sculpture, circular in outline, light brown in color, but has the distinctive hole in one valve. My specimens came from San Pedro Bay, and lived under 600 feet of water. It is also found in the Mediterranean Sea and other parts of the world.

Fig. 3, x $\frac{1}{1}$ (*)

We have in Figure 3 two views of another brachiopod, *Terebratália occidentális,* Dall, the Western Lamp-shell. The figure is of the natural size, as is indicated by the fraction. This shell is not a common one, but is reported from Monterey southward. The valves are white, with ribs of carmine.

Terebratália transvérsa, by., the Red Lamp-shell, (Waldheimia grayi), is well shown in Figure 4. It is by far the most common species of these shells on our coast, and attains its highest development in Puget Sound, where it sometimes grows much larger than the picture. On the east side of Vancouver Island it is reported "to be found in thousands, attached to the

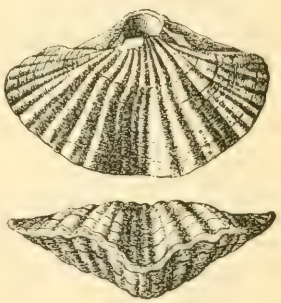


Fig. 4, x $\frac{3}{4}$(*)

rocks." (Taylor.) From that point it extends both northward and southward, reaching from the Aleutian Is. to Catalina I. About San Pedro it can sometimes be found at very low tide. Note that the central scallop on the edge dips downward in this shell, while in the last species it bends upward. The general color is red, though sometimes much of the shell is white. It makes a very pretty specimen for the cabinet.

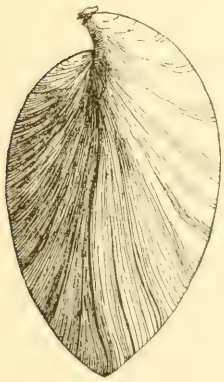


Fig. 5

Láqueus califórnicus, Koch, the California Lamp-shell, Figure 5, is entirely different from the last species, the shell being very thin, smooth, and free from wrinkles of any kind. The hole for the wick is very small also. The color, however, is reddish, at least in large specimens, though some of the little ones are brown. Rich markings of a deeper color sometimes seem to show through the shell. Most of the specimens are obtained by dredging or from fishermen, and sometimes a whole cluster is pulled up, all attached to some old shell, and looking like a bunch of plums. They are mostly collected in the vicinity of the Santa Barbara Channel, though they extend northward at least to Monterey Bay.

Láqueus jéffreysi, Dall, Jeffrey's Lamp-shell, resembles the last species, but lacks the rich, warm, reddish tints. The shell is heavier, browner, and the foramen, or opening, is larger. It is found

farther to the north, and was once called the Vancouver variety of the last species. They exist side by side, however, off the coast of California.

Hemíthrys psittácea, Linn., the Parrot Lampshell, is a northern species found in both oceans. Figure 6 represents a young specimen, showing the complete shell and the interiors of the two valves. The shell is thin, translucent, and of a yellowish gray color. This species has been dredged from the far north to San Diego, out of water sometimes nearly a mile in depth, where the temperature was well down towards the freezing point. The form here shown was once believed to be distinct, and was described under the name of *Frieleia halli*, Dall. That is now regarded as a young stage of the older species.

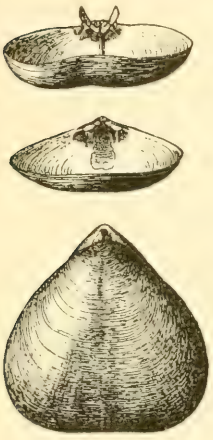


Fig. 6, x $\frac{3}{2}$ (*)

The last member of the brachiopods to be described is closely related to some of the shells that are found in the oldest of the fossiliferous rocks. Perhaps, therefore, it has a direct pedigree reaching back farther than that of any other shell in the world. Its name is *Glottídea álbida,* Hinds, the White Tongue-shell, (Lingula albida). It extends from Monterey to Lower California. I once gathered a few specimens from the mud flats of San Pedro,

Fig. 7, x $\frac{1}{1}$

which were left bare by a low tide. A friend instructed me to dig where I saw little narrow slits in the surface of the mud. I obeyed, and found that the little creatures were buried in holes, the tips of the shells being just beneath the surface. A fleshy stem longer than the shell, reached down into the mud, and served as an anchor. In the picture you see a remnant of the stem, curled and dry. When the tide returned, I dare say the creatures rose a little and began gathering minute particles of food from the water. The shells are smooth, thin, and when freshly gathered are more brown than white. Exposed shells, however, soon bleach. Leaving now the few Lamp-shells which are to be found on this coast, and which have already been described, we turn to another class whose species are numbered by the hundred, and which, though they cannot boast quite so ancient an ancestry, have at least served the human race in a far better manner.

They are named Pélecypods; rather a hard name to pronounce, but no longer than the old name for the same creatures, viz., Lamellibranchs. The latter word refers to the fact that their gills resemble pieces of ribbon, while the more modern name means "hatchet-foot," and was given because many of them dig holes in the mud or sand by means of an organ which bears some resemblance to an axe. Moreover, some of them use this hatchet as an organ of locomotion, and so the term pelecypod has a good reason to exist, though some of the class have no foot at all, and still more never use it to help themselves along. None of them are blessed with a head, a lack of which

organ any one of us would find very embarrassing; but not so our happy clam, for never having possessed a head he feels no need of one.

So he digs a burrow with his hatchet-shaped foot and pulls himself down into it and feels reasonably safe. To be sure he needs food and some kind of breath, but he is so wonderfully made that he has little trouble in obtaining either, for in fact they come together. He has two tubes, or siphons as they are called, which he pushes up through the burrow to the surface of the sand, and then opens them out in the clear water above. Then he starts his pump, which is a double-action affair, and the work begins. Water is sucked down one pipe and forced up the other, and with the water come particles of food and dissolved air for breath. His wonderful gills absorb the latter and gather up the former, which they pass on to the mouth that is waiting to receive the nourishment.

When the tide goes out and the sand is left bare, our happy clam has just to wait, that is all. But if you walk along over his hole he may become startled by your footstep and suddenly pull down his siphons into his shell. As they are full of water, the result will be a little fountain which you will see spouting up for an instant and then disappearing. If you have a hoe or a shovel you may now dig the poor fellow out of his revealed burrow, and his fancied security will prove vain; but if he is a large clam his burrow may be too deep to be easily explored, and if he be lively he may dig too.

If you pick up a dead shell and look inside one of the valves you may see that it is marked somewhat like Figure 59, except that the letters will not be there to guide you. The line p. l. is called the pallial line, because the pallium, or mantle, or plain skin of the animal is attached to the shell along this line. If the creature lives deep in the mud and has long siphons there will be quite a notch at p. s., which stands for pallial sinus. A sinus is a gulf, or bay. If the creature simply lives on the surface, or is only partly buried in the sandy bottom, he will have no need for long pipes, and the p. s. will be omitted.

The two big scars marked a and á show where the adductor muscles were grown to the shell. These muscles are strong affairs, and enable the creature to close his doors with a snap and to hold them closed against all intruders. Sometimes there is but one adductor, as in the oyster, and then it is situated near the center of the shell. But when the clam shuts his shell he is obliged to stretch a thick, heavy spring, which, when it is dry, resembles rubber, though it gets brittle when it is dry. This spring is marked "l" in the picture, which stands for ligament. In some species the ligament is internal instead of external, and in such cases it is compressed instead of lengthened, when the clam closes his shells. In either case the elastic ligament opens the valves as soon as the muscles become relaxed, either by the will of the clam or by his death, for dead shells are nearly always partly open.

The ligament also serves to keep the two valves

from falling apart, and beside it there are more or less hinge-teeth for the same purpose. The lateral tooth is marked "l. t." in the picture, while the three cardinal teeth are situated just below the umbo, which is marked "u." One more mark, namely, "lu," signifies lunule. This is a heart-shaped depression on the outside of the shell, half in each valve, and is seen when you look at the end of the shell, as in Figure 56.

It is interesting to capture a healthy clam and put him in a jar of sea-water with a thick bed of sand at the bottom, and see him adjust himself to the changed conditions. He digs with his foot, and he pumps water through his siphons. His pumps, however, are invisible, for in reality they consist of innumerable little lashing hairs, or cilia, covering the surface of the gills. A bit of gill may be snipped off from a freshly opened oyster or clam and placed in a drop of sea water, under a microscope, and the movement can be plainly observed.

Although the clam has no head, the part which goes down into the burrow first is called the front end, and the siphons always follow. In the dead shell the pallial sinus is therefore always at the posterior end. When a shell is in position for describing, as in the figure, the ligament is at the top. It is easy to see that Figure 59 represents a left-hand valve, for the position of the sinus is plain.

In describing the shells of pelecypods we shall have occasion to call attention to all of these features, also to the epidermis, or periostracum,

which is a kind of horny covering on the outside of the shell that is found in some species. With these simple explanations we will pass on to a description of the species, leaving a fuller account of the animal to the books on zoölogy, merely remarking that the shell is secreted by the mantle.

The first shell of this great class that we are to consider is one that very few will ever collect, for it lives in the ocean where the water is very deep, from one to two miles being recorded by the "Albatross" at some of the stations where it was dredged. Its name is *Solémya jóhnsoni,* Dall, which may be rendered into English as Johnson's Solemya. It is a singular shell, with fingers of epidermis reaching out nearly an inch beyond the edge of the firm portion. The whole shell is about four and a half inches long. It has been dredged from deep water off various parts of the coast as far north as Puget Sound.

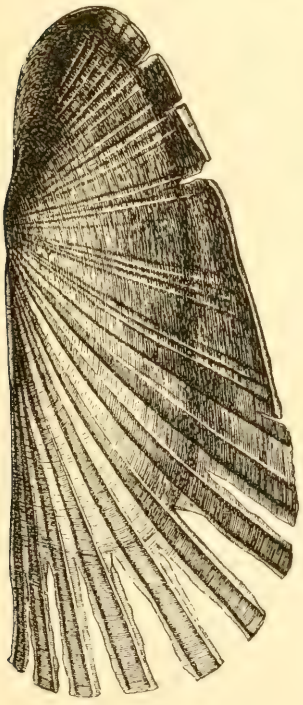


Fig. 8, x $\frac{4}{5}$ (*)

In the descriptions of species the same order will be followed as that adopted for the "List of West American Shells," near the close of this volume. There the classification is given in full, though the notes about each species are very brief. Many of the species will not be described fully, for various reasons, most of which have been set forth at length in the Preface. But hints and suggestions will be freely given to help all who are very properly trying to arrange their specimens in a natural order.

The next shell on our list belongs to the *Nucúlidæ,* and is named *Núcula (Acíla) castrénsis,* Hinds, the Camp Nut-shell. It is well named, for the shell resembles a three-cornered, dark brown nut, while its sides have sculptured markings, reminding one of many steep walled tents. Internally it is beautifully pearly, and it has about seven little hinge-teeth on each side. The whole shell is wedge-shaped, and is about as large as a good sized pea, though it sometimes grows a little larger. This species is seldom found on the shore, but a large number were dredged off the coast of southern California a few years ago. The shells are sometimes thickly coated with fine mud. It has also been found in Puget Sound, and even farther to the northward.

Núcula suprastriáta, Cpr., the Fine-lined Nut-shell, has a much smaller shell, and the sculptured lines are concentric, instead of forming angles. It probably lives within about the same limits as the last species.

Núcula ténuis, var. *lúrida,* Gld., the Thin Nutshell, is the common species found in moderate depths about Alaska, and in deeper water farther south. It has been known as *N. expánsa,* Rve.

Núcula carlotténsis, Dall, the Charlotte Nutshell, is a small species, only 6 mm. long, dredged from deep water off Queen Charlotte's Islands by the U. S. Steamer "Albatross." It has been confounded with *N. exígua,* Sby., which is a Panama shell, smaller, more inflated, and with less conspicuous sculpture.

The shells belonging to the Family of the *Lédidæ* are grouped under two genera, *Léda* and *Yóldia.* Specimens are not common, most of the species living in the sea where the water is deep and cold. A good many species have been found off various parts of the coast. The shells are mostly small, and are rounded at one end, while the other end is more or less prolonged into a horn or hook. Internally, there are many small, comb-like hinge-teeth, extending away from the center on either side. Externally the shells have many concentric markings, and when fresh are covered with a smooth, almost transparent epidermis. Only a few species will be described here, while others will be mentioned in the List, near the end of the book.

Fig. 9, x $\frac{3}{1}$(*)

Figure 9 represents *Léda hamáta,* the Hooked Leda, though the picture is nearly three times as long as the real shell, as is indicated by the fraction, $\frac{3}{1}$. The

shell is compressed and of a dark chestnut brown color. The specimen was obtained by dredging near Catalina Island, in about 300 feet of water.

Another species, considerably larger than the last, but not quite so long as the figure, is *Léda táphria,* Dall, the Grooved Leda. The name is taken from the Greek, and means, "full of ditches or furrows." The shell is as round as a fat bean. There are more grooves on the sides than in Fig. 9, as might be expected from the name, but the narrow end of the shell is much shorter. The specimens in my cabinet were obtained from San Pedro Bay.

The genus Yoldia resembles Leda in some respects, but the shells are generally larger and the posterior end is not so prolonged or distinctly marked. The hinge-teeth are V-shaped and numerous, sometimes numbering 20 or more on a side. There are a good many species found along our coast, but most of them live at a considerable depth, or in the cold waters of the north.

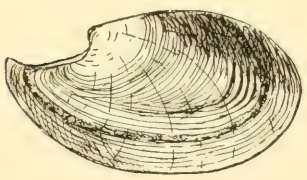


Fig. 10, x $\frac{2}{3}$

The largest of the species is named *Yóldia coóperi,* Gabb, Cooper's Yoldia, and sometimes it grows to a length of two or three inches. The shell is thin and compressed, while the hinge-teeth are very numerous, there being about 12 in front and 40 or 50 behind. The surface has distinct concentric ridges. It is found fossil at San Pedro, and living off the coast of central California. Figure 10.

Yóldia montereyénsis, Dall, the Monterey Yoldia, has a length of 32mm. It was dredged in Monterey Bay, from mud where the water was nearly half a mile deep. The hinge-teeth are about 20 in number on each side, and the epidermis is green. The other Yoldias will be briefly mentioned in the List. It may be well to mention the fact that the name Yoldia is derived from that of the Countess Yoldi, to whom this genus was dedicated by Möller, in 1832.

The genus Malletia resembles Yoldia, but the ligament is external, elongated, and prominent, while in Yoldia it is slight. *Mallétia fába,* Dall, the Bean Malletia, has an elegant little shell, nearly an inch long. It is smooth, ovate, inflated, with a polished epidermis. It has been dredged from deep water off the coast in various places from British Columbia to San Diego.

The *Arcidæ,* though very abundant in some parts of the world, are but poorly represented on this coast. In general they prefer warmer waters, being especially common on the coast of Florida. The Arks, as they are called, have a great number of small hinge-teeth, which are similar in shape, and taken together they resemble a comb. The shells are generally strong and well developed.

Arca reticuláta, Gmel., the Cross-lined Ark, is very small, and has been found from San Pedro southward. *Arca mutábilis,* Sby., and *Arca multicostáta,* Sby., are occasionally found at San Pedro and vicinity, though really belonging to the fauna of Mexico.

Glycýmeris intermédia, Brod., the Medium Ark-shell, is round like a button, and is about half an inch across. The shell is solid, white, though tinged with brown, and its inner edge is finely crenulated. The hinge area is crescent-shaped, and is marked with many small, transverse hinge-teeth. It was formerly called *Axinea intermedia.*

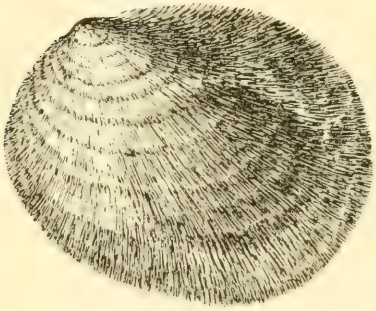


Fig. 11, x $\frac{4}{3}$ (*)

Figure 11 represents both the inside and outside of a remarkable shell from northern Alaska. As it was dredged from pretty deep water, it is probable that very few of my readers will ever see a specimen; but it is well to know about some of the rare forms that live in the sea, even if we never have the privilege of seeing them. The epidermis is densely hairy, and of a brown color. The margin of the shell is curiously bent, making a deep pit behind the hinge. The name is *Limópsis vaginàta,* Dall, and we will call it the Bearded Ark-shell.

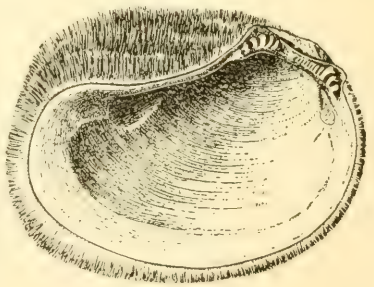


Fig. 11, x $\frac{4}{3}$ (*)

CHAPTER II

MUSSELS AND PECTENS

And now our investigations will take us away from the sea for a little while, and we will leave its rolling waves, its stretches of sand, its high cliffs, and its deep, still, cold abyss. We will make our first trip to the rivers and lakes, and we shall find them inhabited by mollusks also, though it will be easy to distinguish them from the creatures that live in the sea. Throughout our broad land the great streams abound in what are often known as river-mussels. They are especially numerous in the tributaries of the Mississippi, for those streams largely flow over limestone formations, which furnish material for the shells of the mollusks. They are not so common on the West Coast, for the probable reason that the water is not so hard as it is on the other side of the mountains. For many years the mussels were seldom disturbed, but of late years vast numbers of them have been collected for their pearly shells, out of which innumerable buttons are cut and turned. Occasionally a valuable pearl is found inside one of these common looking shells.

The first species to be mentioned in this list is *Margarítana margartífera,* Linn., the Pearly River-mussel. In the upper Sacramento River, near Redding, they are numerous and grow to the

length of about four inches. They have even been found in streams of the northern Sierras, up to the height of 5,000 feet. They also live in Oregon, Washington and the East.

The shell is oblong in shape, with the umbo near one end. There is a strong, prominent hinge-tooth, also distinct muscle-scars and an unbroken pallial line. The interior of the shell is pearly and deeply tinted, usually purple but sometimes blue or salmon-colored. The outside is covered with a dark, horny epidermis, usually much eroded at the umbones. The river-mussels do not burrow deeply, but are only partly buried in the sand. They love quiet stretches where the current is not too strong, and where there is but little danger that they will be overwhelmed with sand or mud. They multiply rapidly, though many of the young ones perish after they are thrown out into the current to shift for themselves. Those that survive begin to build shells, and when they are once established their growth is rapid. *M. falcáta,* Gld., is a variety of the above species.

The Anodontas belong to the same great family, but are destitute of hinge-teeth, as their name indicates.

Anodónta nuttalliána, Lea, Nuttall's Anodon, is shown in Figure 12. This river-shell is very thin, of bluish pearl within, and is covered with a greenish-brown epidermis. The hinge line is prolonged obliquely upward, forming a nearly right triangle above the oval part of the shell. Its length is three inches. The specimen from which the

engraving was made was taken from the San Joaquin River.

Dr. Isaac Lea described three other species from this part of the country, all of which are closely related, and which Dr. Stearns regards "as varieties of one and the same species." If we take the

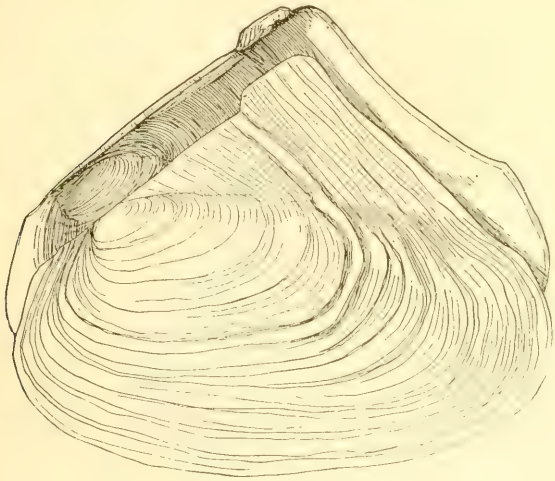


Fig. 12 x $\frac{1}{1}$

same view, they will all belong to *nuttalliana*, as that species was described first. I will give, however, Dr. Lea's original description for each of the three. The names will indicate where the specimens were originally collected.

Anodónta wahlamaténsis, Lea, the Willamette Anodon. "Shell winged, triangular, somewhat inflated, inequilateral; valves thin and connate; beaks rather compressed and undulated at the

tip, epidermis somewhat shining; nacre white. More inflated than *nuttalliana.*"

Anodónta oregonénsis, Lea, the Oregon Anodon. "Shell subalate, elliptical, somewhat inflated, inequilateral; valves thin, beaks scarcely prominent, undulated at the tips; epidermis somewhat shining and striate; nacre white."

Anodónta californiénsis, Lea, the California Anodon. "Shell subalate, smooth, elliptical, somewhat inflated, rounded behind; valves thin, beaks very small and undulated at the tips; epidermis olive-colored, shining; nacre white and iridescent. Smaller and more inflated than *nuttalliana.*"

Anodónta kennérlyi, Lea, Kennerly's Anodon. Lea's description is as follows: "Shell smooth, elliptical, subcylindrical, somewhat ventricose, very inequilateral, somewhat truncate before, biangular behind; valves very thin, semitransparent; beaks scarcely prominent, finely and closely undulate at the tips; epidermis yellowish olive, shining, striate at the margin without rays; nacre bluish-white and very iridescent. From near Puget Sound."

Anodónta dejécta, Lewis, the Low Anodon, is a species related to Gonidea angulata, though it lacks the sharp shoulder of that species. It is smooth and shining, slightly winged, with a thin epidermis which gradually wears off in exposed places; somewhat rayed in the posterior regions. The interior is lurid, brownish or purplish, shading to lighter at the edges. It grows to be over three inches in length. It is found in Arizona

near Tucson, at Laguna Station, San Diego Co., Cal., and also in Mexico.

Anodónta beringiána, Midd., Bering's Anodon. This A. yuokanensis, Lea, of which the description is as follows: "Shell smooth, elliptical, very much inflated, very inequilateral, somewhat biangular behind, rounded before; valves somewhat thick, beaks a little prominent, somewhat undulate at the tips; epidermis dark brown, without rays;

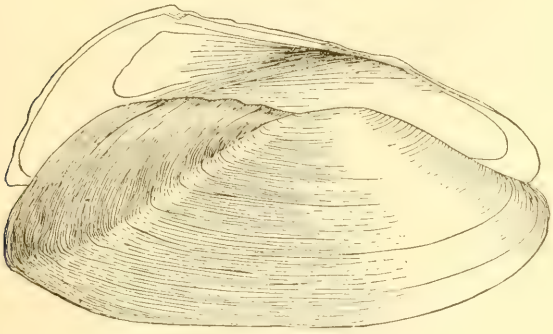


Fig. 13 x $\frac{3}{4}$

nacre whitish. This species lives in Kamchatka and vicinity." Dr. Lea's specimens were supposed to have come from the Yukon River.

Gonídea anguláta, Lea, the Angled Anodon, Figure 13, (Anodonta angulata). The typical form is very distinct, a sharp ridge dividing the shell into two unequal parts, as shown in the cut. This ridge fades out, however, in other specimens, and is sometimes nearly or quite wanting. The epidermis is dark brown, the shell pearly within, and

somewhat flesh-colored. The common length of adult specimens is three or four inches. The range of this species is from central California to British Columbia northward, and Idaho eastward.

Returning to the sea once more, we first mention a remarkable new shell obtained a few years ago by Mr. and Mrs. Oldroyd, of Long Beach, Cal., from fishermen who took it alive from 25 fathoms of water in San Pedro Bay. It was named *Atrína oldroýdii*, Dall, and we may call it Oldroyd's Pinna. In fact, it is the first Pinna found in this part of the world, although in some portions of the ocean these great "feather-shells" are common enough. The specimen in question is over nine inches long, pointed at one end, and broad above. Its color is almost black, while the inside is a dark olive gray, with some iridescence. The description was published in 1901.

From a very large shell we turn to a very small one, one-eighth of an inch in length. It is white, oval, and shaped like a minute Pinna. It is named *Philobrýa setósa*, Cpr., the Moss-lover, (Bryophila setosa). It occurs from Santa Barbara southward.

The great family of the Mussels have elongated, dark-colored shells and most of them spin a byssus of strong threads by which they anchor themselves to a place of safety. Where the waves dash over the rocks and the white foam curls like flowing milk, there the mussels love to make their home. Moored by their strong cables they enjoy the rush of air and water and fear no danger.

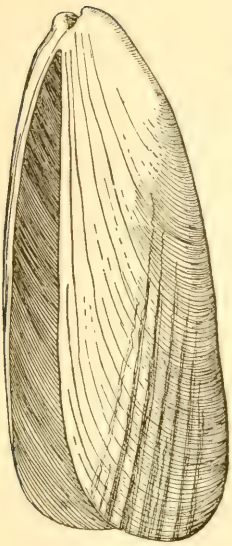


Fig 14 x $\frac{1}{2}$

The principal species on our coast is named *Mýtilus californiánus,* Conr., the California Mussel. A good picture is given in Figure 14. This species can easily be distinguished by the conspicuous ribs, which are never wholly absent, particularly on the newest parts of the shell. The beaks of old specimens are apt to be much eroded, but the growing edge is protected by a glossy epidermis. The general color of the shell is purple, though the thicker parts of it are white, and sometimes there are streaks of brown, which harmonize remarkably well with the purple. Occasionally a very large and perfect specimen is polished on a lapidary's wheel, and the result is remarkably pretty. But far more often we see nature's method of bringing out the colors. If you find a little beach near a mussel ledge you will notice that the sand contains unnumbered bits of blue and white and brown, all bright and polished and forming the most lovely bed of gaily colored gravel. If you examine the pieces you will find that most of them are nothing but broken mussel shell, and you will admire the bright colors which blend so perfectly. And while speaking of colors, let me ask you to observe the combinations all along the rim

of the ocean. What soft tints of olive green in the seaweeds, enlivened by the brilliant red of a starfish or the bright emerald of a frill of Ulva. How beautifully they harmonize with the gray of the rocks and the blue of the sea and sky. What fertile suggestions for an artist who is seeking new patterns for a fabric or a carpet.

But to return to our mussel, the flesh of which is bright orange-colored. Its shell is one of the first on our coast that received attention in Europe. In 1789 Captain George Dixon published an account of his voyage around the world, and speaks of finding this species on the northwest coast of America, in the following words:

> We saw, also, on this coast a kind of mussel, in color and shape much like the common edible mussel of Europe, but differed in being circularly wrinkled and a great deal larger. One valve I saw at Queen Charlotte's Islands measured above nine inches and one-half in length. With pieces of these mussels, sharpened to an exquisite edge and point, the Indians head their harpoons and other instruments for fishing. They fasten them on with a kind of resinous substance.

Mýtilus edúlis, Linn., the Edible Mussel, is the same species that is found on the shores of the Atlantic. The shell is smooth and regular and is covered with a dark, glossy epidermis. The shell is smaller than that of the last, and it is more often found in quiet water. In San Francisco Bay, a variety, *glomerátus,* Gld., is found clinging in large groups to posts and wharves. Its length is seldom more than two inches. It is one of the few mollusks commonly found for sale in the San Francisco markets.

There is another mussel, found chiefly in the south, concerning which there has been much discussion. In West Coast Shells it is called *Mytilus bifurcatus,* Conr., but it seems to have been confounded with another shell of the same name. In 1898 it was renamed *Mytilus stearnsi,* Pils. & Raym., Stearns' Mussel, and by this name we trust that it will continue to be known. Externally it greatly resembles Figure 15, though it is usually considerably smaller. Internally it may be distinguished from a Septifer by the absence of a deck across the point of the umbo.

Fig. 15

Figure 15 is a good picture of the little shell referred to above. Its name is *Séptifer bifurcátus,* Rve., the Branch-ribbed Septifer. Its generic name means partition-bearer, and was given from the fact that a little shelly deck is stretched across a small part of the interior of each valve near the umbo. The shell is strong, has a thick, dark epidermis, and is very pearly within, where the color varies from white to dark purple. Outside, the ribs increase in number towards the edge of the shell, sometimes seeming to actually fork into two. Sometimes the outside is exceedingly eroded and almost all signs of ribs disappear, or the surface may become incrusted with foreign substances. The Septifer spins a strong byssus and attaches itself to stones, where it may dwell in safety. Occasionally a specimen is found nearly twice as long as the picture. On the whole, this is a very interesting shell, and should be sought for, especially in the south.

Closely allied to the common mussels is another group of shells which for some reason have been popularly known as "horse-mussels." The true name is Modiolus, formerly spelled Modiola, which means a little measure, or drinking cup. They are usually more solitary in their habits than the true mussels, and they often spin a kind of covering, filled with bits of broken shells. Some live in the mud, with only a small part of the shell above the surface. In all of these shells the umbo is not at the extreme point, as in the mussels, but a part of the shell projects by the hinge, forming a rounded lobe.

Of the species found on this coast there is first *Modíolus modíolus,* Linn., the Great Horse-mussel, most abundant in northern waters. In Puget Sound there have been found specimens nine inches long and four inches in diameter, standing perpendicularly in the mud. The epidermis is strongly bearded near the edge of the shell, while the buried parts are strongly eroded. They grow rapidly.

Modíolus cápax, Conr., is a similar species from the south, though I have grave doubts whether it is really distinct from the last species. I have gathered them abundantly about San Pedro. When the epidermis peels off from the outside of the shell the latter often appears of a brick red color.

Modíolus réctus, Conr., the Straight Horse-mussel is shown in Figure 16. The shell is long and narrow, thin and delicate. The epidermis near the hinge end is dark brown and glossy; in front it is light brown, with numerous chaffy hairs; internally the shell is white. The common

length is three or four inches, but a variety *flabéllus,* Gld., found in British Columbia and in deep water off the coast of California, grows to a much larger size.

Modíolus fornicátus, Gld., Arched Horse-mussel, has a very short and full shell, somewhat wedge-shaped, having a breadth more than half of its length. The naked shell is white, though sometimes tinted, and it is normally covered with a light brown epidermis, especially near the edges. This shell is sometimes found solitary, but at

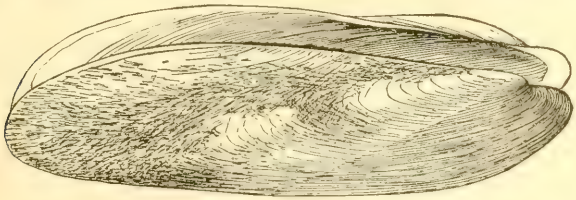


Fig. 16

other times in large masses, grouped around the base of a seaweed, or in some similarly protected situation. The common length is about an inch.

Modíolus plicátulus, Lam., the Plaited Horse-mussel, is really an Atlantic species, being extremely abundant formerly in the "Back Bay" of Boston, a spot now covered with beautiful streets and fine buildings. It doubtless came to California with seed oysters, which were planted in San Francisco Bay, where it may now be found in considerable numbers, and where it may ultimately become as abundant as it was in Boston. It has a rather pretty shell, about two inches long, with a glossy epidermis. It is marked by a great number of small but very distinct plaits or ribs, radiat-

ing forward from the umbo. The ligament is long and strong, and the interior of the shell is tinted with purple.

It is extremely interesting to note the different habits which members of the same family now possess, and which they may have acquired long ago and passed down to posterity. The long, singular shell shown in Figure 17 is evidently a kind of mussel, but its owner prefers a safe, sheltered retreat to a mere anchoring place on the side of a wave swept cliff. The name of this species is *Adula falcáta,* Gld., the Pea-pod Shell. Among the difficult things to explain is the fact that a mol-

Fig. 17

lusk, with a thin and flexible shell, can bore a deep hole into hard rock. But this creature does it, for I found the rocks of Duxbury Reef at Bolinas almost alive with this and other borers. It spins a byssus, too, like other mussels, and attaches itself to the sides of its burrow. The figure represents a rather large specimen. The inside of the shell is white and pearly, while the outside is covered with a dark chestnut epidermis, which has numerous transverse wrinkles.

Adula stylina, Cpr., the Short Adula, is smaller, shorter, and has very angular shells with a brown epidermis destitute of distinct wrinkles.

Lithóphagus plúmula, Haul., the Rock-eater, has a small, cylindrical shell, rounded in front and tapering behind. It constructs a burrow some-

times in rocks and sometimes in old shells. It has a light brown epidermis, and is an inch or two in length.

Modiolária táylori, Dall, Taylor's Modiolaria, has a little shell, hardly a quarter of an inch long, shaped like a true Modiolus. It has a greenish epidermis, with dark purple nacre shining through. It was found in tide-pools at Victoria, B. C., by Rev. G. W. Taylor.

Modiolária vernicósa, Midd., the Varnished Modiolaria has an oval shell, with beaks near one end. It is smooth, reddish brown, and has a brilliantly polished epidermis. Its length is 15mm. and it is found in Alaska. Other species will be found mentioned in the List.

Crenélla decussáta, Montagu, the Netted Crenella, is a little affair about 3mm. long, which is circumboreal in its range. The valves are rounded, and marked by numerous radiating ribs. The edge of the shell is crenulated behind the ligament area. While it is sometimes found in San Pedro Bay, its home is in the north, where several other allied species are found.

The Pectens, or Scallop-shells, are among the most pleasing mollusks to be found in the ocean. Of regular shape, brightly colored, and finely sculptured, it is no wonder that these shells have been imitated in all sorts of carved work. And if one is fortunate enough to become acquainted with a live specimen, he will be abundantly rewarded by watching its interesting habits. We have a good many species on this coast, some of which are not too distinct.

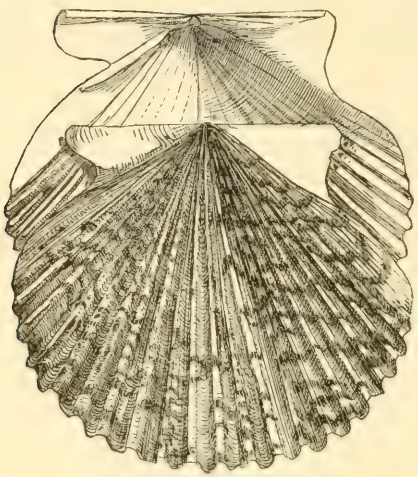


Fig. 18

The first in importance is *Pécten aequisulcátus,* Cpr., the Speckled Pecten, a good view of which is given in Figure 18. This species abounds in the south, where it can be dredged, though good specimens are often found at low tide. This creature can swim freely by flapping its broad shells, though it sometimes moors itself to a piece of seaweed by spinning a byssus with the aid of a singular little organ shaped like a finger. You will notice in the picture a little notch in the back shell, just under the left "ear," through which the little creature thrusts out the finger when spinning the threads. In a good specimen you will find that this opening is set with little projections, like the teeth of a comb.

Pécten caurínus, Gld., the Weather-vane Shell, (Amusium caurinum), is a large species found in the north, which has very broad, thin, and flat shells, marked by about twenty ribs. The edges are thin, the ears small, and the color white within

and light brown without. Diameter five or six inches.

Pécten diegoénsis, Dall, the Diego Pecten, sometimes known as Pecten floridus, Hinds. This fine shell sometimes grows nearly as large as the last species, though it is totally distinct. Its two valves are unlike, one being nearly flat, while the other is moderately arched. Both have very large and distinct ribs, twenty or more in number, with deep channels between them. The shells vary in color from dark red on the flat side to yellow on the curved. A fine specimen, three inches across was given me some years since, by a lady living in Pacific Grove, who found it alive at low tide. Its color is yellow throughout. Fine, large specimens have also been dredged at various places. As its name indicates, its home is in the south.

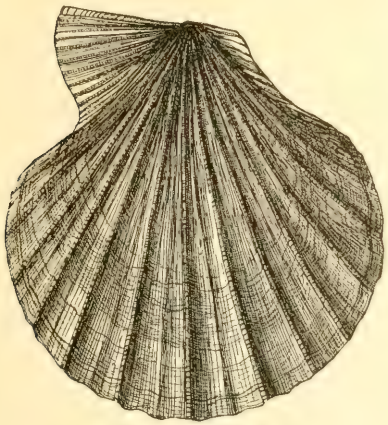


Fig. 19

Figure 19 represents an exquisitely beautiful species which is essentially a northern, deep water inhabitant, though it is occasionally found quite far down the coast. The shell is thin, the ears very unequal, and the edges of the principal ribs are cut into many short and

slender teeth. The valves differ from each other in sculpturing and color, the under one having more ribs and being nearly white, while the upper one is richly marked with concentric bands of pink. Its name is *Pécten hericeus,* Gld., the Pink Pecten.

In West Coast Shells it was named *Pécten hastátus,* Sby., the Spear Pecten. That name is now applied to a similar species, closely allied, found in deep water off Southern California, the adult shells of which are about one and a half inches across. The ten very prominent ribs on the back have long-toothed combs, while the colors of the shell are very vivid, ranging through various tints of red, yellow, and purple.

Pécten rúbidus, Hds., the Red Pecten, is from the north, and closely resembles Figure 19, but the ribs are more smooth and even, and are without the serrations so prominently seen in that species.

Pécten latiaurítus, Conr., the Broad-eared Pecten, is a southern species, about an inch across, having thin valves, with twelve to fifteen squarish distinct ribs. The ears of the shell, by which we mean the flattened parts on each side of the umbo, are broad and pointed. Color, white and brown.

A variety of this species, known as var. *monotímeris,* Conr., is shown in Figure 20. In West Coast Shells it was described as a distinct species. The shell is very thin and delicate, the ribs rounded and rather faint, and the ears are smaller than in the last. The colors incline to yellow and brown, vari-

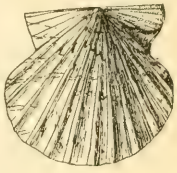


Fig. 20

ously mottled with zigzag lines of white. I have found this species living at San Pedro, and at times it is abundant as far north as Carmelo Bay, near Monterey.

Pécten davidsóni, Dall, Davidson's Pecten, is represented in Figure 21, the form and sculpture of both valves being plainly shown. The left valve has twenty-one rounded ribs, while the right is nearly smooth. The color is waxen white. It was dredged from deep water off Alaska, and in Bering Sea.

Fig. 21 x $\frac{4}{3}$ (*)

Pécten randólphi, Dall, Randolph's Pecten, was obtained by the U. S. Fish Commission from deep water at various stations extending from Bering Sea to Mexico. The shell is thin, glossy, and unsculptured, translucent white in color, and measures about an inch in diameter.

Pécten vancouverénsis, Whiteaves, the Vancouver Pecten, is perhaps the smallest member of the genus to be found on our coast. The little shells are only 5mm. across, and are very fragile. Form nearly circular, ribs fine and numerous, color very light brown. It has been collected in British Columbia, also in San Pedro Bay at a depth of two hundred fathoms.

Pécten ventricósus, Sby., Bulged Pecten, is found fossil at San Pedro, but is said to be living from Santa Barbara southward. "P. aequisulcatus re-

sembles this species very closely, but is thinner and flatter and has narrower ribs." (Arnold.) Diameter, about two inches.

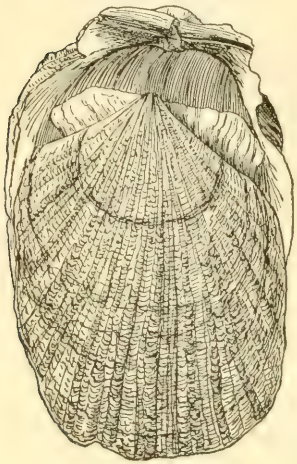


Fig. 22 x $\frac{2}{3}$

We now come to a notable species which differs from the typical Pectens in that the valves become unsymmetrical when they become old. It is called *Pécten (Hínnites) gigánteus*, Gray, the Purple-hinged Pecten. In its early life it is a true little fan-shell, with thin, fine-ribbed, unequally eared left valves, some white, some yellow, and some red, while the right valves have about twelve serrated ribs and are apt to be mottled in color. When the shell is about an inch long a reddish purple spot begins to show along the hinge area, inside the valves. This spot increases with age, and never fades, though the shell may be sadly worn and broken. Fragments of shell on the beach show the color distinctly. At the same time the little creature quits its free life and settles down in some quiet nook, like the inside of an old abalone shell. There it turns over on its left side and begins to grow, fastening itself firmly to the nook that it has chosen.

And now, as it is confined, it loses its perfect symmetry and grows in whatever direction it has

room, sending out short spines and thorns for defence. Sometimes it becomes a giant indeed, with thick shells four or five inches long; but more often it is considerably smaller. The ligament is internal, lodged in a deep, narrow pit; the central muscle-scar is smooth and very large. Live specimens are not common, but dead shells are thrown up all along our coast. Figure 22 shows a long and narrow specimen.

Fig. 23

Lima dehiscens, Conr., (Lima orientalis), the File-shell, is shown in Figure 23. It resembles a Pecten, but the ears are small. The animal can swim freely. The shell is pure white, delicate, oblique, the valves gaping on one side. Sculpturing fine and straight, like the teeth of a file. It is sometimes thrown up by storms, and is also found attached to seaweed. Some specimens grow much larger than the figure. It occurs from Monterey southward.

CHAPTER III

OYSTERS AND SMALL CLAMS

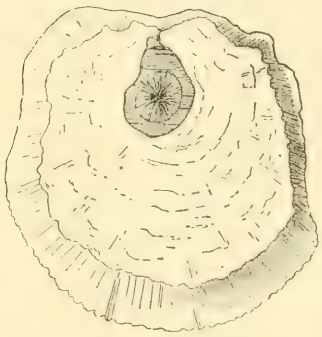


Fig. 24

The shell shown in Figure 24 is found along the whole coast. Its name is *Mónia macroschísma,* Desh., the Pearly Monia. It is also known as Placuanomia and Pododesmus. It belongs very closely to the oyster family, but has decided differences. You will notice that one of the valves is much smaller than the other, and that it also has a large hole in the center, through which you can see an oval muscle-scar with lines radiating from the center. The small valve is rarely found, as it usually adheres to the rock, even after the death of the animal, while the upper valve is torn off by the waves and washed ashore. The outside of this upper valve is rough, and marked by irregular, radiating ridges; but the inside is sometimes beautifully pearly, the green and purple tints being most common. There are two muscle-scars, the lower one of which is not shown in the cut, but it is smaller and smoother than the other. The shell is normally circular,

though it assumes various shapes. The picture represents a rather small specimen. When the structure and color of the interior are once known, even a small fragment of this shell can be readily recognized.

Anómia lámpe, Gray, the Lawless Shell. This is a southern species, smaller than the last, having a very thin and delicate shell. It also lies upon its right valve, which is concave and perforated. Through the opening runs a strong byssal plug, firmly attaching the whole to the support on which it rests. Color, yellow, shining; upper valve marked with four muscle impressions, instead of two, as in the last species. It gets its name from its irregular habits of growth.

The oysters come next, and they can be quickly disposed of. While the fossil shell-beds in the Coast Mountains show that in a former geological age the oysters of this coast grew to huge dimensions, a single shell weighing several pounds, yet now the native oyster of Puget Sound and the California coast is a little affair, the greatest dimension of the shell being only two inches, while most specimens are still smaller. This native species is named *Ostrea lúrida,* Cpr., the Lurid Oyster. There are two quite distinct varieties, *expánsa,* Cpr., which is nearly circular and is attached by the whole surface of the lower valve, and *rufoídes,* Cpr., whose shells are reddish in color. Although of small size, these oysters make a very delicious stew.

Ostrea virginiána, Lister, the Eastern Oyster, is brought here from Baltimore and other Atlantic

ports. The young oysters when about an inch long easily endure the seven or eight days of travel across the country, and when planted in our bays they thrive and grow rapidly. In three or four years they are ready for the market. While they do not seem to reproduce very successfully, it is certain that some of the young survive and grow. More experiments in artificial propagation are needed.

Fig. 25

We now come to a very different family of mollusks, namely, the *Cardítidae*. Figure 25 gives a good idea of *Cardíta (Carditamera) subquadráta,* Cpr., the Little Heart-shell, (Lazaria subquadrata). The name is very much longer than the shell, of which the picture is even too large. It has a firm, hard little shell, however, and can easily be identified by the strong ribs which radiate from one corner. Color, brownish-white, the inside sometimes stained with purple. It may sometimes be found alive, attached to stones, while dead specimens are often washed up with the gravel on the beach.

In Figure 26 we have a life size picture of the inside of the right valve of *Calyptógena pacífica,* Dall, the Pacific Calypto. The outside of the shell is nearly smooth, being marked only by lines of growth, though the

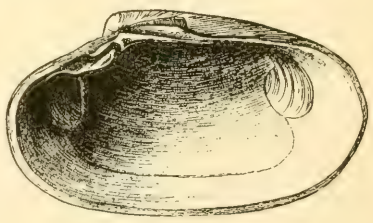


Fig. 26, (*)

white shell is covered by a thick, greenish epidermis. It was dredged off Dixon Entrance, Alaska, in 322 fathoms of water. You will notice in this shell, as in all belonging to this great family, that the pallial line is entire, showing that these creatures do not burrow deeply in the mud at the bottom of the sea.

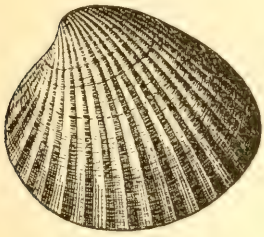


Fig. 27, (*)

Figure 27 gives a good external view of *Venericárdia alaskána,* Dall, the Alaska Venus-heart. It was collected at Nunivak Island, in Bering Sea. Notice the strong ribs, the lines of growth, and the artistic outline of the shell.

Figure 28 shows both an inside and an outside view of *Venericárdia ventricósa,* Gld., the Ventricose Venus-heart. These figures, as explained by Dr. Stearns, were made from a specimen found in Puget Sound. The species lives, however, from the Aleutian Islands in the north to Catalina Island in the south, where it has been dredged in thirty fathoms of water.

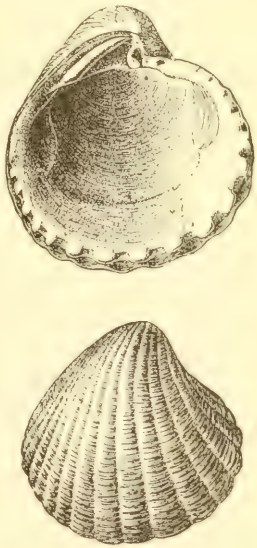
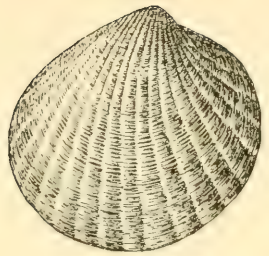


Fig. 28, x $\frac{2}{1}$ (*)



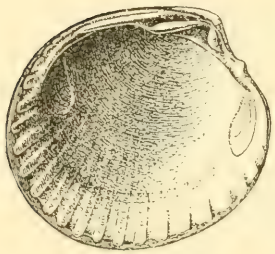


Fig. 29, x $\frac{2}{1}$ (*)

Venericárdia barbarénese, Stearns, the Santa Barbara Venus-heart, shown in Figure 29, resembles the last species, but is more circular, has more ribs and a less prominent beak. Dredged off Santa Barbara Islands in green mud, at 276 fathoms depth.

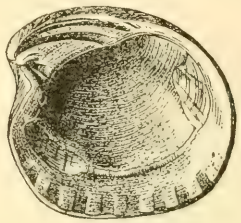


Fig. 30 (*)

Figure 30 gives an inside view of *Venericárdia crássidens,* Brod. & Sby., the Heavy-toothed Venus-heart. The figure is of the natural size, and the specimen from which it was made was obtained in the vicinity of Icy Cape. Notice the very heavy hinge-teeth, from which the species received its name.

The last member of this family to be noticed is named *Milnéria mínima,* Dall, the Least Milner-shell. It was discovered by Dr. Wm. H. Dall in 1866, at Monterey, where it was found nestling on the backs of abalones. It is a curious little bivalve, about as large as a grain of wheat, light brown in color, very strongly angled, and marked

by numerous lines of growth. It is worth looking for.

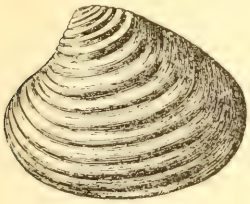


Fig. 31 (*)

The members of the genus Astarte have thick shells covered with dark, heavy epidermis. Astarte, by the way, was the Syrian Venus, so we have another mythical name added to the many which have gone before. As Venus was supposed to represent beauty, so the beautiful shells are appropriately given her various names. Figure 31 represents *Astárte alaskénsis,* Dall, the Alaska Astarte. The figure is about natural size, and very plainly shows the peculiarities of the shell. The epidermis, or periostracum, is very dark, and becomes black in old shells, while the shell itself is white. This species lives in Bering Sea, and has been found as far south as Puget Sound.

Astárte poláris, Dall, the Polar Astarte, is shown in Figure 32, which is somewhat enlarged. The shell is more delicate than the last, with finer and more numerous ridges, and it has a polished, light brown epidermis. It comes from Alaska, near the Shumagin Islands, also from Baffin's Bay on the Greenland Coast.

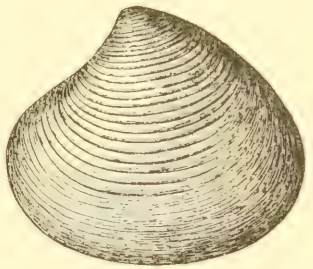


Fig. 32, x $\frac{4}{3}$ (*)

Fig. 33, x $\frac{7}{8}$ (*)

Figure 33 shows the appearance of the Esquimalt Astarte, *Astárte esquimálti,* Baird, which may be easily recognized by its irregular sculpture, so clearly shown in the figure. This species ranges from the Aleutian Islands to Puget Sound.

Astárte vernicósa, Dall, the Varnished Astarte, is a small species, with a shell covered with yellow-brown periostracum, brilliantly polished. It is found in Bering Sea. There are also several other species of Astarte, which will be briefly mentioned in the List.

Fig. 34, x $\frac{2}{1}$ (*)

Crassatélla margináta, Cpr., the Margined Crassatella, is a minute, southern shell, about the size of a large pin-head. Somewhat triangular, yellowish, marked with brown chevrons.

Chlamydocóncha orcútti, Dall, Orcutt's Cloak-shell, is a singular mollusk, discovered by Mr. Charles R. Orcutt under stones in False Bay, near San Diego. It is a bivalve mollusk, but the shells, singularly enough, are internal, and very minute when compared with the size of the body, which is about an inch long. The animal is shaped somewhat like a cowry, and the flesh is translucent and jelly-like.

Under the *Leptonidae* we have quite a number of shells, most of them small.

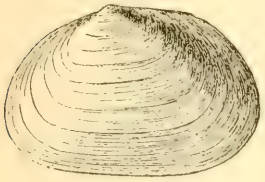


Fig. 35, × $\frac{2}{1}$ (*)

Figure 35 gives an enlarged view of *Erycína compréssa,* Dall, the Compressed Erycina, which has a thin, white, compressed shell, covered with a thin, wrinkled periostracum. It occurs in Bering Sea and southward as far as Sitka. Erycina is another name for Venus.

In Figure 36 we have a singular combination. The greater part of the picture is a ventral view of the Mud Prawn, *Gébia pugeténsis,* Dana, which lives in Puget Sound, and is very expert in burrowing in the soft sand. But attached to its abdomen is a little mollusk, represented of natural size, which the prawn carries along wherever it goes, whether willingly or not I do not know. This little mollusk is named *Erycína rugífera,* Cpr., the Rough Erycina. It was formerly called Lepton rude, Whiteaves.

Fig. 36 (*)

We now come to two

little shells, very smooth and pretty, the first of which is named *Kéllia laperoúsii,* Desh., the Smooth Kelly-shell. When living, it is covered with a shining, light brown epidermis. Ligament small, internal. This little nestler lives in sheltered places, such as holes in the rocks; often in the deserted homes of the piddocks, or rock-borers. I once found a whole colony of them, of different ages, all living happily together within the valves of a dead clam. The shell is somewhat oval in shape, and is about half an inch in length.

Kéllia suborbiculáris, Montagu, the Globose Kelly-shell. A little bivalve, thin, delicate, and light colored, about one-third of an inch in length. The little creature can spin a byssus with its foot and attach itself at will to any protecting object. It is often found among the twisted roots of seaweeds. It is an interesting fact that this species lives not only on this coast, but is found in Europe as well, thus connecting the Atlantic and the Pacific.

Fig. 37, x $\frac{6}{1}$ (*)

The members of the genus Mysella are very small creatures, with thin, sometimes transparent shells. Figure 37 represents the inside of a valve of *Mysélla aleútica,* Dall, the Aleutian Mysella. Its shell is solid, smooth, and white, with a polished, straw-colored epidermis. Its length is only 4.3mm.

A closely related shell is the little *Lásea rúbra,*

Montagu, the Red Lasaea. As the name indicates, it is reddish brown in color. This shell is found living on the coast of England, as well as on this coast. It loves to hide in the roots of small seaweeds and in cracks of the rocks. Jeffreys says it is viviparous, and lives as much out of the sea as in it.

Another little creature that lives on the shores of the Atlantic and the Pacific is *Turtónia minúta*, Fabr., which the naturalist, Rev. J. G. Wood, calls the Little Mullet-shell, because it is often found in the stomachs of mullets. He advises all zoölogists to examine the stomachs of such fishes as they can obtain, since they often contain objects of much interest. "This little shell," says he, "is about the size of a capital O, is exceedingly thin, purple-brown in hue, dark at the beak. It may be found by looking among the roots of corallines and other Algae." On our side of the world it lives on the coast of northern Alaska.

Turtónia occidentális, Dall, the Western Mullet-shell, also lives in Bering Strait and northward. It is said to be larger, stouter, and shorter than the last species.

We now come to the great suborder *Lucináca*, named from Lucina, one of the titles of the goddess Juno, in heathen mythology. The shells internally are marked with one very long and narrow muscle-scar, while the other is nearly round. The pallial line which joins them has no sinus.

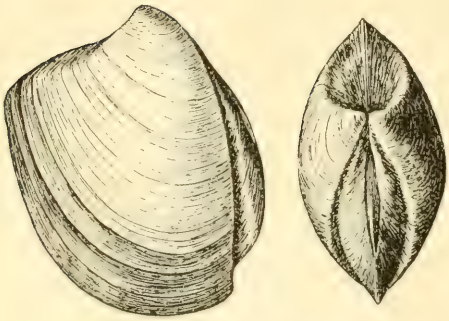


Fig. 38, x $\frac{4}{5}$ (*)

Figure 38 gives two views of *Thyasira bisecta*, Conr., the Cleft Thyasira, which was found in Puget Sound in deep water by Prof. O. B. Johnson. It has also been found in the far north. It is the largest species of the genus, sometimes measuring two or even three inches across. The figure plainly shows its peculiarities.

Thyasira barbarensis, Dall, the Barbara Thyasira, resembles the last, but the beaks are more nearly in the center. It was formerly known as Cryptodon and Axinus. It ranges from Washington to Mexico. The shell is white and chalky externally, and measures 17mm. in length.

Thyasira excavata, Dall, the Sculptured Thyasira, has a thin, white shell, with a yellowish epidermis. The side of the shell is deeply infolded, making a sharp excavation. Length, 20mm. Dredged from deep water off Oregon, and in the Gulf of California.

Fig. 39, x $\frac{4}{1}$ (*)

Axinópsis víridis, Dall, the Green Axinopsis, is shown in Figure 39. The polished, pale-green periostracum gives the shell its specific name. It is only a quarter of an inch across. Dredged from muddy or sandy bottom. This little mollusk lives along the coasts, from Japan and Bering Strait down to Catalina Island. How full of life are the waters of the ocean!

Axinópsis sericátus, Cpr., the Silky Axinopsis, is very similar, but the outline is less circular. From Puget Sound, also Alaska and California. The silky epidermis suggested its name.

Diplodónta aleútica, Dall, the Arctic Diplodonta, ranges from the Pribilof Islands to the Aleutian chain, and eastward to the Shumagin Islands. The picture represents a young specimen, having a silky, olivaceus epidermis. Other species grow to the length of an inch or more, and are coarse and chalky.

Fig. 40, x $\frac{2}{1}$ (*)

Diplodónta orbélla, Gld., the Round Diplodonta, is a not uncommon California shell. It is a pretty species, smooth and white, and the valves are so much inflated that small specimens resemble white marbles. It is said that the animal has a habit of forming a protecting nest of sand, cemented by mucous. This nest has long, tubular openings for the siphons, so that the inmate is wholly concealed.

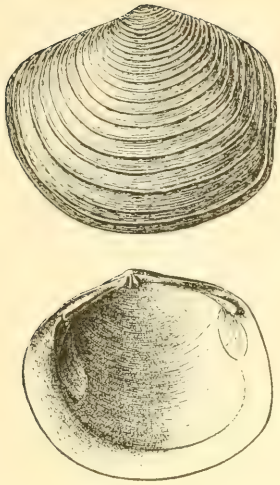


Fig. 41 (*)

In Figure 41 a nearly life-sized view is given of both the inside and the outside of *Phacoides æquizonátus,* Stearns, the Banded Lentil-shell, a rare species, specimens of which were dredged from deep water in the Santa Barbara Channel. Most of the shells of the genus Phacoides, which means "lentil-like," were formerly called Lucina, a name applied to one or more of the heathen goddesses of the olden time.

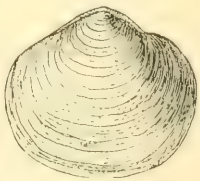


Fig. 42

Figure 42 represents one of the most common bivalve shells to be found along the coast of central California. Its present name is *Phacoides califórnicus,* Conr., the California Phacoides, (Lucina Californica). It is pure white, circular in outline, and varies in size from the diameter of a dime to that of a half-dollar. The cardinal hinge-teeth are small, while the lateral ones are strong. The ligament is external, and the lunule, in this species, belongs wholly to the right valve, instead of being divided nearly equally between the two. As in other species of this genus the forward muscle-scar is long and narrow, and the pallial line is entire.

I have gathered a few specimens from the gravel among rocks at Pacific Grove, when the tide was very low, and have collected many empty, but really good shells that had been cast up by the waves. It is one of the shells which you will be sure to find on the little beaches beyond the lighthouse at Point Pinos, where, from the island cliffs, there is one of the finest sea views to be had anywhere along the coast.

Phacoídes nuttállii, Conr., Nuttall's Phacoides, (Lucina nuttallii), is similar in shape to the last species, but is much more highly sculptured. The sharp, fine lines of growth are crossed by many delicate rays, making its surface look like fine basket work. It is somewhat flattened and ridged along the hinge-line. Color white, length an inch or less, southern.

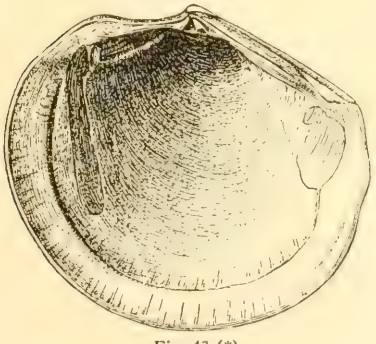


Fig. 43 (*)

In Figure 43 we see a drawing of the inside of a valve of *Phacoídes annulátus,* Rve., the ringed Phacoides, a large shell, which ranges from Sitka to San Pedro, living in moderately deep water. This is the species formerly known on this coast as Lucina borealis, and sometimes as L. filosa, Stimp., which, how-

ever is an Atlantic species. Also, L. acutilineata, Conr. (Arnold). The outside of the shell is marked by sharp concentric ridges.

Phacoides tenuiscúlptus, Cpr., the Fine-fined Phacoides, is shown in Figure 44. It occurs mostly in the cold waters of the north, ranging from Puget Sound to Bering Sea, though it occasionally occurs as far south as Catalina Island. Alaskan dredgings from muddy bottoms yield it abundantly. Shell chalky, usually somewhat abraded.

Fig. 44, x $\frac{3}{2}$ (*)

Still another illustration of a member of this genus is given in Figure 45, which shows both the inside and outside of *Phacóides richthófeni,* Gabb,

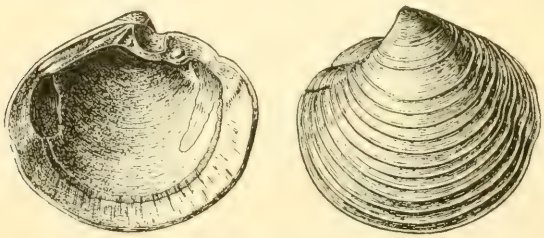


Fig. 45, x $\frac{4}{1}$ (*)

the Heavy Lentil-shell. It is found at Catalina Island, Long Beach, and southward, never plentifully. It is a small, heavy shell, the picture being made from a young specimen, cleanly marked.

CHAPTER IV

CHAMA, CARDIUM AND VENUS

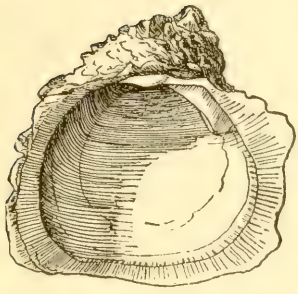


Fig. 46

We pass now to some very different shells; very irregular, very rough, and very firmly fixed in their places. A picture of one of these shells is shown in Figure 46. This species named *Chama pellucida,* Sby., the Agate Chama. You notice by the figure that the inside of the shell is smooth enough, and that there is a big, oblique hinge-tooth near the upper right-hand corner. The outside, however, is very rough, being covered by many close frills, which are translucent, like agate or chalcedony. Sometimes these are white or almost colorless, and sometimes they are dashed with rosy red. The inside of the shell is lined with a white, opaque layer, which is beautifully crenulated at the edge. The living shell is always attached to some firm support, like a rock or a post. So strong is the adhesion that you must break off a part of the rock or you will sacrifice a part of the shell. It is very easy to overlook them, as they appear like ragged knobs on the rock, but when you have collected a good specimen you will greatly admire its peculiar beauty. Upper valves are

often torn off by the waves and washed ashore. They are easily identified, though a novice often confounds them with limpet shells. I have some exceedingly beautiful specimens that were taken from the piles that had been pulled up from a disused wharf at San Pedro.

Cháma exogýra, Conr., the Reversed Chama, has a coarser, more opaque shell, with little beauty of form or color, being usually of a dirty white. The chief difference, however, is seen in the curve of the umbones. If you stand a specimen of this species on its edge, with the beaks uppermost and curving towards you, the side which was attached to the rock will be towards your left hand. But if you place a specimen of *pellucida* in the same position, the rocky side will be towards your right hand. I have gathered the two species growing side by side, and I have never known this rule to fail.

Cháma spinósa, Sby., the Spiny Chama, is a southern species, living mostly along the Mexican coast, but perhaps reaching as far north as San Diego. It resembles the first species, but its ridges are broken into close, short spines.

We now come to the interesting family of the Heart-shells, or Cockles, as they are called in many places. There are over two hundred species of them known in different parts of the world, and they vary exceedingly in size and appearance. They are very decidedly heart-shaped, whether you look at them from the front or the back of the shell. Most of them have prominent ribs running from

the umbo to the edge of the shell. Internally there is a central hinge-tooth, and also strong lateral ones, somewhat removed to the right and left. The pallial line is simple, for these creatures do not burrow. They have a long and strong foot, however, by means of which they can move rather freely, or even anchor themselves, if such an operation is necessary.

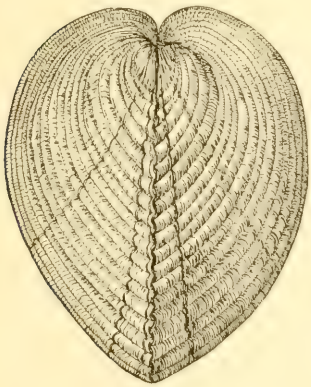


Fig. 47

Figure 47 gives a good end view of *Cárdium córbis,* Mart., the Basket Cockle. This is the most common species on the west coast, occurring as far south as San Diego. But the true home of this species is in the cold water of the north. At Fort Wrangel in Alaska, I collected very fine specimens, one morning when the tide was low, some of which were four inches across. The shell is rather brittle, being of an earthen texture, and specimens are easily broken. Like most of the creatures of the sea, the cockles make an excellent article of food. This species lives as far north as Bering Sea, and follows down the other coast to Japan. It includes C. nuttalli, Conr.

Cárdium californiénse, Desh., the California Cockle, has a similar range but is reported only

as far south as Monterey. The ribs on this species are close and flat, and the margin regular. A variety,*comoxénse,* Dall, is reported from the boulder clay of Vancouver I., that has the ribs so flattened that they are defined only by the interstitial lines. C. pseudofossile, Rve., and C. blandum, Gld., are included in *C. californiense.*

Cárdium ciliátum, O. Fabr., the Bearded Cockle, ranges through the boreal seas and descends to Cape Cod on the eastern, and to Puget Sound on the western coast. The shells are small and bearded. There are many varieties, which have received various names.

Cárdium biangulátum, Sby., the Angled Cockle, is a southern species, being found from the Santa Barbara Is. to Panama. It has a heavy shell, 40 mm. high, with strong ribs. The interior is reddish.

Cárdium elátum, Sby., the Giant Heart-shell, is the largest species of the genus, sometimes being fully six inches high. Its range is about the same as that of the last species. Yellowish externally, white inside, the ribs very slightly elevated.

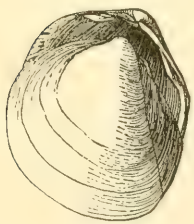


Fig. 48

Cárdium substriátum, Conr., the Egg-shell Cockle, (Liocardium substriatum), is another southerner, very much smaller than the last, for Figure 48 represents a large specimen. Obscure ribs are generally visible, and the smooth shell is mottled, especially inside, with reddish brown splashes, like a sparrow's egg.

Cárdium quadrigenárium, Conr., the Forty ribbed Cockle, is another southern species, and grows in deep water to a remarkable size. In spite of its name the ribs are usually rather more than 40 in number. While the shell is young the ribs are comparatively smooth, but when older they are set with yellow teeth, or short horns, giving the shell a very peculiar appearance. The strong crenulations on the edges of the valves are also yellow, especially in adult specimens.

Sérripes grönlándicus, Gmel., the Greenland Serripes, is an Arctic species coming down to Cape Cod and Puget Sound, like C. ciliatum. Its hinge-teeth are small and almost obsolete, and the surface is smooth or only slightly radiately striate.

Protocárdia centifilósa, Cpr., the Hundred-lined Cockle, has a small, thin shell, whose surface is sculptured with very many exceedingly fine lines. Umbones prominent, outline circular, length 23 mm., range from B. C. to San Diego. A var. *richardsónii,* Whiteaves, reaches from the north to the coast of Oregon. It is very small and rare.

From the interesting Heart-shells we turn with reluctance, but our journey will now take us away from the ocean for a little season.

Fig. 49

Our first shell will be an extremely small one, represented in Figure 49. The name of this little creature is *Pisídium ábditum,* Hald., the Hidden Pea-shell. It lives in fresh water, and has a thin, oval, brown shell, marked by minute lines of growth. It is widely distributed, being found even in New Mexico, and natur-

ally it has many synonyms. Its variety *occidentále,* Newc., is found in a little brook running out of Mountain Lake, near San Francisco. The shell is about one-eighth of an inch in length.

Pisídium compréssum, Prime, the Compressed Pea-shell, is rather unfortunately named, for it is plump and full, of the shape and size of a radish seed. It is covered with a brown epidermis, and is found in Washington and also in Arizona.

Pisídium ultramontánum, Prime, the Western Pea-shell, is still smaller than the last species. Shell thin, smooth, light brown. From Utah, also from Duck Lake, Lassen Co., and Feather River in Plumas Co., Cal.

Pisídium rowélli, Sterki, Rowell's Pea-shell, is a species with a translucent, rather thin shell, 7.5 mm. long, collected near Sisson, at the base of Mt. Shasta, by Rev. J. Rowell.

Pisídium áshmuni, Sterki, Ashmun's Pea-shell, has a minute, horn-colored shell, less than 3 mm. long. From San Rafaels, New Mexico.

Pisídium idahoénse, Roper, the Idaho Pea-shell, has a large shell, with beaks scarcely raised, exterior yellow and glossy, interior bluish white, length 8 mm. From near Old Mission in Northern Idaho. Also from Seattle, collected by Mr. P. B. Randolph in 1895.

Fig. 50

Figure 50 gives a good representation of a typical species of the next genus, *Sphaérium sulcátum,* Lam., the Furrowed Sphere-shell. The mollusks of this genus are closely allied to those

of the last, but are generally larger and have two separate siphon tubes, while in Pisidium they are united. This species is found in Cal., Utah, and Oregon. Length of shell half an inch or less.

Sphaérium patéllum, Gld., the Plate-shell. Shell very thin, smoother and less robust than the last, and half the length. Specimens from Sonoma Co., Cal.

Sphaérium occidentále, Prime, the Western Sphere-shell, is nearly circular in outline, with a shell quite smooth and firm, robust, same size as the last. From Weber Canyon, Utah.

Sphaérium dentátum, Hald., the Toothed Sphere-shell. Hatchet-shaped, when viewed from the side, but bulged at the umbones and cordate at the ends. Epidermis olive green, glossy, shell 6 mm. long. From the Chehalis River.

We now come to the *Venaracea*, a sub-order including many of the most interesting shells to be found along our coast. The first one to describe is named *Dosínia ponderósa*, Gray, the Heavy Dosinia. Its home is near the equator but it is found northward from Peru to San Pedro Bay. The shell is nearly circular, about four inches in diameter, pure white internally, but creamy brown on the outside. It is very smooth, save for concentric lines of growth, and the deep lunule is heart-shaped. The valves are thin at the edges, but very thick and heavy in the older parts. The pallial sinus is V-shaped, and the ligament is external.

Transennélla tantílla, Gld., the Little Transennella, has a shell ranging from ⅛ to ⅓ of an inch

in length. It is somewhat triangular, its surface very smooth and bright, its external color white, or perhaps marked with brown, while internally it is white with a purple stripe at the posterior end. It was called Psephis tantilla, in W. C. S., and it has also received various other names. It ranges from Sitka to Mexico.

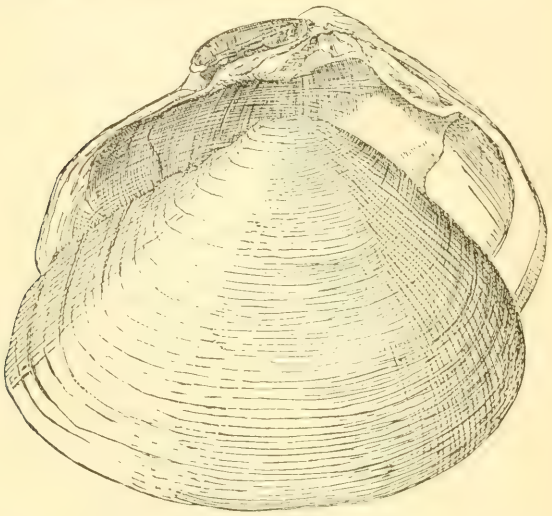


Fig. 51

Figure 51 represents a very large, heavy shell now known as *Tivela stultórum,* Mawe, the Great Tivela. Of course that is not a correct translation of the Latin; that you may do for yourselves, only avoid the joke; but as this is the largest and finest species of the genus we may well call it "Great." It was called Pachydesma crassatelloides in W. C. S., and it has also had a good many other names, all of which have been duly considered at the

Smithsonian Institution, and the one most entitled to permanence has been selected to remain.

The specimen figured above was over five inches in length, and weighed over a pound, without the animal. The valves are very thick and heavy, even to their edges, which are smooth and finely rounded. Hinge-teeth strong, heavy ligament external, pallial sinus small. Externally the shell is smooth, yellowish white, sometimes marked with conspicuous purple rays, and is partly covered with a glossy epidermis. The inside is white, with purple muscle-scars. The Tivelas live from Santa Cruz southward, and burrow but slightly. Sometimes at low tide the farmers come down with a plow and run furrows in the sand, turning out the mollusks like potatoes. They are highly esteemed by lovers of a good clam chowder, and occasionally they even get into the city markets.

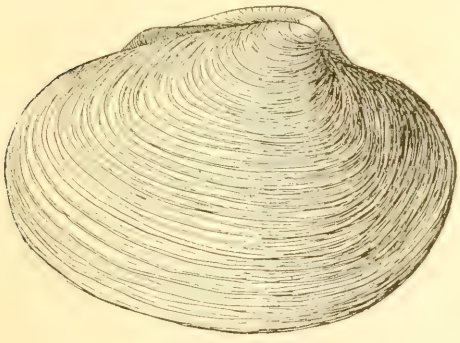


Fig. 52

Amiántis callósa, Conr., theWhite Amiantis, is shown in Figure 52. This is a beautiful, pure white, southern shell, three or four inches in length. The valves are thin at the edges and thick near the umbones. Externally there are no rays whatever, but many concen-

tric, rounded ridges, some of which divide into two.

Pitária newcombiána, Gabb, Newcomb's Pitaria, Figure 53, has been found in moderately deep water from Monterey southward. It is thin and delicate, with zigzag, brown markings, and a papery epidermis.

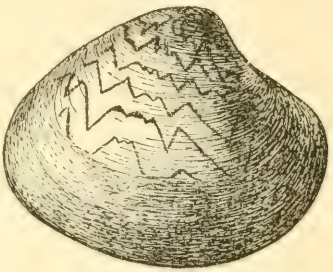


Fig. 53, x $\frac{5}{9}$ (*)

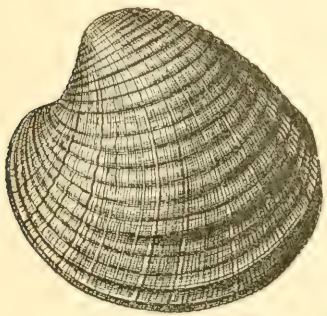


Fig. 54 (*)

Figure 54 gives a bold picture of *Cytheréa fórdi,* Yates, Ford's Cytherea, which is found from the Santa Barbara Is. to Panama. It is very thick and heavy, and has a very deep lunule. It reaches a length of two and a half inches. This is the shell which passed for years as Venus toreuma, Gld., but that is found to be a distinct Polynesian species.

The Saxidomes of this coast have recently been revised by Dr. Dall, and the numerous names reduced to two. The first is *Saxidómus nuttállii,* Conr., Nuttall's Saxidome, shown in Figure 55. It includes the old Saxidomus aratus, Gld. The shells are usually marked by rough concentric ridges, as shown in the figure. When young, there are brownish markings near the beaks, with a

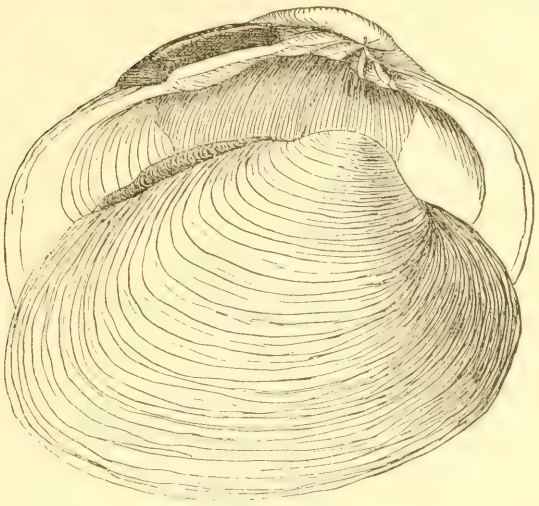


Fig. 55

trace of purple internally on the upper, posterior margin. The hinge-teeth are strong, and the sinus deep. This shell sometimes reaches a length of nearly five inches. It is found from central California to San Diego.

Saxidómus gigánteus, Desh., the Giant Saxidome, is the other species. It ranges from the Aleutian Islands to the Bay of Monterey. It is solid, broad and heavy, but the concentric structure is much less pronounced than in the last species. While the young are yellowish white, and the exterior is sometimes fulvous, the interior is always white. The adult is said to sometimes reach a length of 130 mm. I gathered numerous specimens at Sitka, averaging about 3 inches in length, and nearly that in height. They were

pure white inside, and almost glossy, while externally they were comparatively smooth and quite chalky. This shell has been confounded with S. squalidus, but that is a South American species. The Oregon Saxidomes which are sold in the markets of Portland belong to S. giganteus.

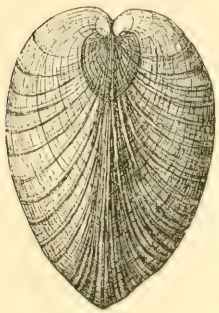


Fig. 56

There are three species of Chione upon the coast, which have received, however, several times three names. Figure 56 gives an end view of *Chióne succincta,* Val., the Banded Chione. The cordate lunule is a prominent mark, while on the other side of the beaks is the long and deep escutcheon. Numerous ribs radiate out from the umbo, but those in the middle generally become flattened towards the edge of the shell. The concentric ridges, as shown in the picture, run around the shell somewhat like hoops around a barrel. The interior is white, while the outside is a dingy yellow.

Chióne undatélla, Sby., the Wavy Chione, (C. simillima), is a species which varies considerably, but can usually be told readily by the great number of concentric lamellæ, which are closer together as they come nearer the edge of the shell, almost completely concealing the ribs. The valves are inflated, thick, and heavy. Sometimes the interior is purple around the pallial sinus. These shells, which are seldom over two inches long, are found abundantly in southern California.

Chióne fluctífraga, Sby., the Smooth Chione, is about the size of the others. There is no distinct lunule, as in the other kinds, and the rib sculpture in the middle of the disk becomes fainter with age, till it sometimes almost disappears near the edge of the shell. Internally the valves are more or less purple. All three of these species have strong, heavy shells, which are marked by fine internal teeth around the edges. Farther to the south there are many other species.

Vénus kennicóttii, Dall, Kennicott's Venus, is a very rare shell found at Neah Bay, Washington, and off the coast of central Cal. It is finely and closely lamellose over the whole surface. It somewhat resembles the common V. mercenaria of the Atlantic coast. Length, two and a half inches.

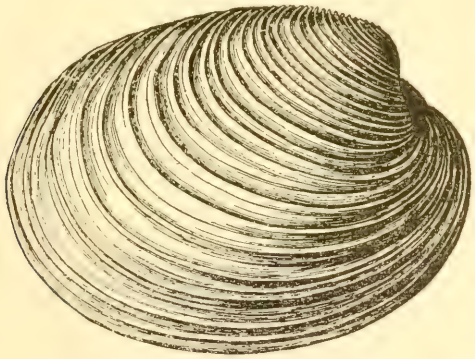


Fig. 57 (*)

Figure 57 represents a fine, large shell, taken alive at Sitka. A worn valve was found many years ago at Carmel Bay, near Monterey. Its

name is *Márcia kennérleyi,* (Cpr.) Rve., Kennerley's Marcia. It is nearly three inches in length, and is grayish white in color.

Márcia subdiáphana, Cpr., the Translucent Marcia, lives in Alaskan waters, and also as far south as the Santa Barbara Channel, in tolerably deep water. The shell is thin, white, with an olive gray epidermis, and reaches a length of over two inches. It was described by Carpenter under the name Clementia.

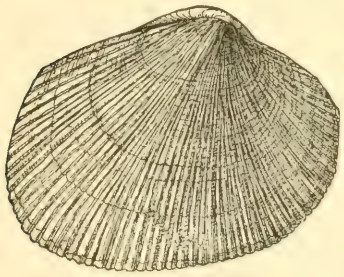


Fig. 58

Figure 58 represents one of the commonest shells to be found on the western coast. It has received quite a variety of names, but it is now classed as *Páphia stamínea,* Conr., the Ribbed Carpet-shell, (Tapes staminea). It is one of the few mollusks sold freely in the San Francisco markets, where it is known as the Hard-shelled Clam. In color it varies from pure white to chocolate, and some of the varieties are prettily marked with chestnut chevrons. While it occurs all along the coast it is most abundant to the north of San Francisco. The name Paphia related to Paphos, one of the haunts of the goddess Venus, for whom so many shells are named. Among the numerous varieties of this shell we mention var. *pétiti,* Desh., the large, unmarked kind found north of the

Columbia River; var. *laciniáta,* Cpr., a southern form with a beautiful network covering, and many small prickles, (Tapes lacineata). Var. *ruderáta,* Desh., has distinct, concentric ridges, sometimes larger than the ribs; var. *orbélla,* Cpr., includes swollen and irregular specimens, living in holes in the rocks, while most common specimens live in coarse gravel and grow to regular shapes.

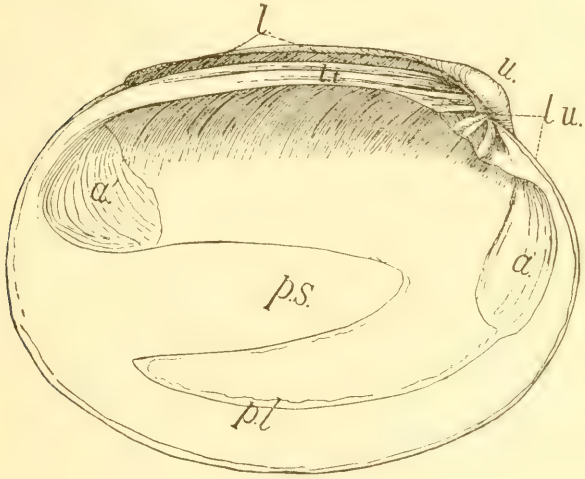


Fig. 59, x $\frac{3}{4}$

Páphia tenérrima, Cpr., the Finest Carpet-shell, (Tapes t.) is a rather rare species, very distinct, and very pleasing in appearance. An inside view of a left-hand valve is given in Figure 59, to which reference has been already made on page 17. The outside of the shell is marked with many low, concentric ridges, and innumerable, minute ribs. The valves are thin and the color is brownish gray.

Fig. 60, x $\frac{3}{2}$ (*)

Figure 60 represents *Liocyma scammoni,* Dall, Scammon's Liocyma, which is found in British Columbia. The shell is dark, solid, with strong hinge and ligament. The pallial sinus is small.

Liocyma viridis, Dall, the Green Liocyma, is a far northerner, being found in both directions from Bering Strait. The shell is oval, and when fresh it is of a fine olive-green color, which bleaches to cream. In each valve are three cardinal hinge-teeth, the middle one being cleft.

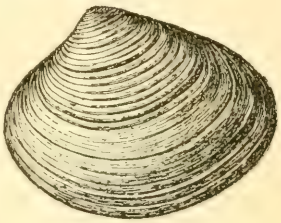


Fig. 61 (*)

Fig. 62

Venerupis lamellifera, Conr., the Rock-Venus, (Rupellaria l.) is shown in Figure 62. The shell is white, very irregular, and is marked with many thin, concentric laminæ, which sometimes are very prominent. There may also be a trace of obsolete ribs. In habit it is a nestler among rocks. Some specimens are considerably larger than the figure.

Figure 63 gives two good views of *Psephidia lordi,* Baird, Lord's Pebble-shell, a plump little species which lives off the shore, below tide line, from

Fig. 63, x $\frac{3}{4}$ (*)

Alaska to southern California. In color it is white or pale tinted.

Psephídia ovális, Dall, the Oval Pebble-shell, is larger, more oval, and more compressed. The shell is white and polished. Its range is about the same as that of the last species. Viviparous.

Gémma gémma, Totten, the Gem-shell, is a very small bivalve recently introduced into San Francisco Bay, with seed oysters from Chesapeake Bay. The shells are nearly round, and are marked with delicate concentric ridges. The color is white, or they may be tinged with purple. Many specimens are not larger than big pin-heads. The inflated, trigonal variety is known as var. *purpúrea*, H. C. Lea.

We have now left the great Venus Family, with its numerous, thick-shelled representatives, and are passing on to those mollusks which resemble the more delicate Tellens.

Our first shell is named *Petrícola carditoídes*, Conr., the Rock-dweller. Normally the shell is oval, with radiating ribs, but it has a habit of boring into soft rock, or getting into a hole that was there before, and then growing to fit the premises. For this reason it happens that specimens differ much in external appearance. Sometimes one is long and narrow, while its neighbor is shaped like a fat bean. The ligament is external, the hinge-teeth strong, though sometimes they are nearly obsolete, while the shell becomes thick and rough. Color, dingy white; length, an inch or sometimes two inches.

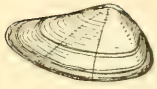


Fig. 64

Figure 64 is a rather poor picture of *Dónax lævigáta,* Desh., the Smooth Wedge-shell, (D. californicus). This species is found abundantly in southern California, living just under the surface of the sand. It is short and stumpy, cut nearly square off at one end and tapering to a rounded point at the other. The edges are finely crenulated. In color the shells vary from white to purple, and are often beautifully striped. This species is sometimes used for food, in spite of its small size.

Dónax califórnica, Conr., the California Wedge-shell, (Donax flexuosus), is quite distinct from the last, and is easily distinguished by the fact that it is thinner, lighter, and the posterior end is much more prolonged, bringing the beaks nearer the middle of the shell. Less highly colored than the last. This species includes D. navicula, Hanley.

CHAPTER V

OTHER BIVALVE MOLLUSKS

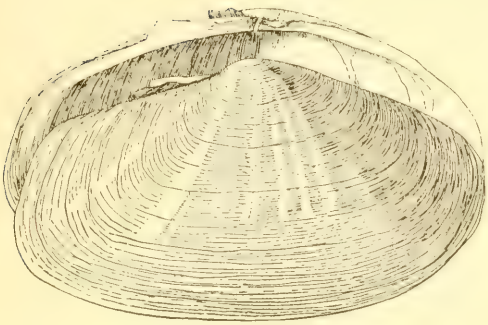


Fig. 56

While returning one morning from a ramble over the rocks that had been left bare by the fall of the tide, I was much surprised to see what seemed to be two white worms moving about in a little hollow between two mossy rocks, which was filled with sand and seawater. They were long and round, and about the size of a lead pencil. As soon as I disturbed them a little they disappeared beneath the surface of the wet sand. Suspecting what these singular creatures might belong to, I at once began to dig, and soon came upon a fine clam, with a shell like that shown in Figure 65. I was exceedingly glad to make the acquaintance of a real, live *Psammóbia califórnica,* the California Sand-shell (P. rubro-radiata), for so I learned to call him. As I wanted to see

more of him, I took him home in a large jar filled with sea-water and sand, and had the pleasure of seeing him dig a burrow and throw out his really beautiful siphons.

Within, the shell is of the purest white, resembling fine porcelain. The pallial sinus is large, the hinge-teeth small, and behind them is a thickened portion of shell about half an inch long, which terminates quite abruptly, exposing part of the ligament. Externally it is white, with red rays running from the umbones, while the newer parts are covered with a brown epidermis. "In Puget Sound this shell grows to a length of five inches." (Mrs. M. S. Drake.)

Psammóbia edéntula, Gabb, the Great Sand-shell, is a fine large species, resembling the last, but having the beaks only one-third of its length from the front end of the shell. The posterior portions are broad and full. The external ligament is very conspicuous, and the hinge-teeth are present in spite of its name, two on the right valve and one on the left. The specimen before me was dredged in San Pedro Bay, and measures five inches in length.

Heterodónax bimaculátus, d'Orb, the Spotted Heterodonax, differs greatly from the true Donax, being oval in shape, rather flat, thin, and marked with fine, concentric lines. Its colors are very diverse, white and purple being the prevailing tints. It is usually less than an inch in length; southern.

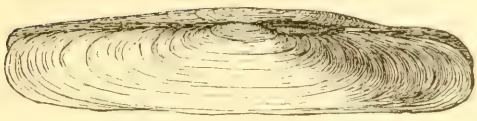


Fig. 66

In Figure 66 we have a good representation of *Tágelus californiánus*, Conr., the Short Razor-clam, (Solecurtus c.). These creatures live in sandy mud, in a perpendicular burrow, and have a gray shell partly covered with a dull epidermis. The wild ducks are said to relish them heartily. Length, two or three inches; southern. The variety *subteres*, Conr., is small, compact, with violet rays and a very dark epidermis. It occurs with the common form.

Sanguinolária nuttállii, Conr., Nuttall's Sanguinolaria, is a southern species, having a thin, oval shell, partly covered with a dark brown epidermis. The colors of the shell are white and lilac, the latter being sometimes beautifully rayed. One valve is much more bulging than the other, and the ligament, just behind the beaks, is very prominent. The shell is two or three inches long.

The name "Tellen" comes from a Greek word, meaning a certain kind of mussel; but when we use it we think of a flat, thin, bivalve shell, with very small hinge-teeth, and a deep pallial sinus. Many of the tropical Tellens are very

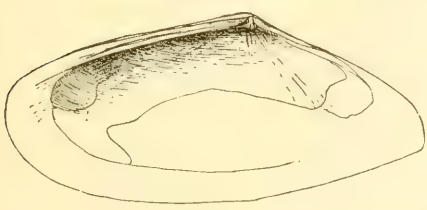


Fig. 67

bright and beautiful. Our first species is named *Tellina bodegénsis,* Hds., the Bodega Tellen. Figure 67 shows the inside appearance of a right valve. Externally the shell is smooth, with a polished surface, creamy white, and marked with fine, concentric lines. Old specimens show a marked tendency to thicken the shell from the inside. This species is found more abundantly in the north.

Fig. 68, x $\frac{4}{5}$ (*)

Figure 68 gives two views of *Tellina búttoni,* Dall, Button's Tellen, (Angulus obtusus). A strengthening, interior rib is seen just in front of the sinus. The shell is thin, white, and polished, but sometimes it has a green periostracum.

Tellina carpentéri, Dall, Carpenter's Tellen, (Angulus variegatus), resembles Figure 69, but is smaller. It is pink and white, glossy, flat and narrow, hardly half an inch long.

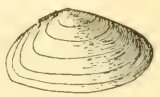


Fig. 69

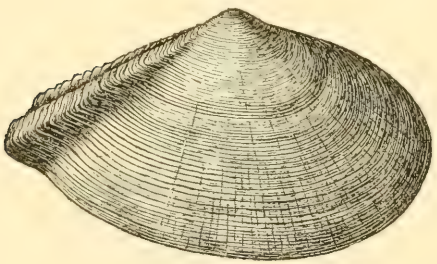


Fig. 70 (*)

Tellina idæ, Dall, Ida's Tellen, is well shown in Figure 70. This rare and beautiful shell was named in 1891 in honor of Mrs. Ida

Shepard Oldroyd. It has since been collected sparingly at Long Beach, San Pedro, and Catalina Island. The color is white. The excellent figure represents an unusually large specimen.

Tellina merópsis, Dall, the Pure Tellen, (Angulus gouldii), is shown in Figure 71, which is much magnified. The shell is white, sometimes yellowish within, thin and delicate, somewhat angled and bent behind, as shown in the cut. It is about half an inch long, and is found from San Pedro southward.

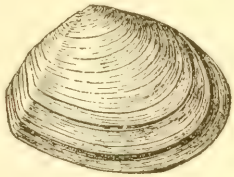


Fig. 71, x $\frac{2}{1}$ (*)

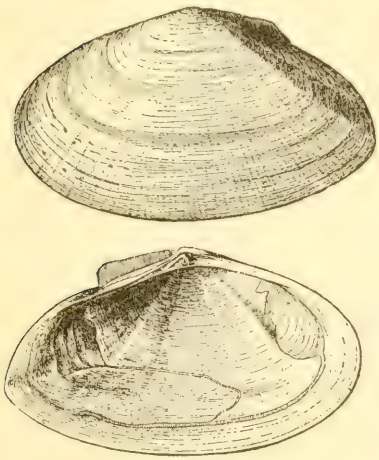


Fig. 72, x $\frac{5}{6}$ (*)

Tellina lútea, Gray, the Muddy Tellen, comes from the very far north, being found in the neighborhood of Bering Strait. It is a fine large shell, and its general appearance is well shown in the two views of Figure 72.

Tellina modésta, the Modest Tellen, is shown in Figure 69, on a previous page, which is of the natural size. It is found in Puget Sound. The shell is thin, white, and glossy,

the pallial sinus very deep, and there is an internal ridge near the forward muscle-scar.

Tellína salmónea, Cpr., the Salmon-colored Tellen, (Moera salmonea), is a very distinct little species, variable in color, but constant in form. The typical shell is quite thick, about half an inch long, nearly rectangular in form, the beaks being near one corner and the external ligament at one end. The surface is very smooth and glossy, but shows distinct lines of growth. It is nearly white on the outside, but within it is beautifully salmon-tinted.

Tellína santarósæ, Dall, the Santa Rosa (Island) Tellen, is shown in Figure 73. It considerably resembles T. bodegensis, but is thinner, flatter, and has different details of sculpturing. It is found around the Santa Barbara Islands.

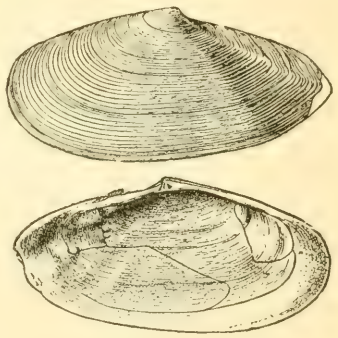


Fig. 73, x $\frac{4}{5}$ (*)

At various points around San Francisco Bay are great heaps of rubbish, which mark the site of old Indian camping grounds. They are always situated close to some spring or brook, the presence of which is now generally indicated by a growth of willows. They are of various shapes and sizes and often cover as much ground as would suffice for a large garden. These mounds

are largely made up of old shells, ashes, and charcoal dust. This shows that the Indians had their fires there, and that they threw away the rubbish which was left from their meals, and then returned to repeat the operation on the slowly rising pile.

It is interesting to examine the shells of these old heaps, and thus see what species formerly abounded on the adjacent mud-flats. I have found various kinds of shells, but by far the most abundant ones are those of the species named *Macóma nasúta*, Conr., the Bent-nosed Macoma, Figure 74. Although so abundant then, this species seems to be dying out, and its place is being rapidly occupied by the introduced Rhode Island clam, *Mya arenaria*, which we will presently consider, but not a specimen of that shell is found in the mounds. *Macoma nasuta* is a common species on the coast, reaching from Kamchatka to Mexico. It inhabits muddy flats, burrowing quite deeply, and reaching the water by two small, red siphons. The shell is smooth, flat and thin; rounded in front, but narrowed and bent to one side behind. The hinge-teeth are small, and in one valve the pallial sinus reaches to the forward muscle-scar. Its color is white, and the common length is two inches.

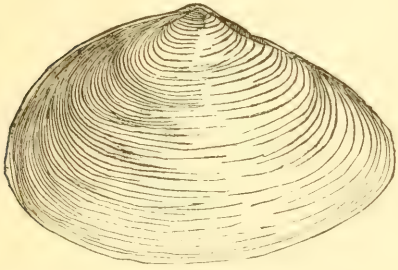


Fig. 74

Macóma inquináta, Desh., the Polluted Macoma, is a variable species, resembling a degraded M. nasuta. In this species, however, the pallial sinus does not touch the forward muscle-scar in either valve. The shell is white, and measures about an inch and a half in length.

Macóma bálthica, Linn., var. *inconspícua,* Brod. & Sby., the Little Macoma, (M. inconspicua). The shell of this species is well shown in Figure 75. The little shell is thin, flat, and either white or pink. The figure represents a good-sized specimen, though it grows still larger.

Fig. 75

Macóma inflátula, Dall, the Inflated Macoma, resembles a young M. nasuta, but is thin, rather inflated, strongly bent, has a pointed posterior and a greenish epidermis. It is a northern species, but is found in deep water farther to the south.

Fig. 76, x $\frac{4}{5}$ (*)

Macóma sitkána, Dall, the Sitka Macoma, is shown in Figure 76. The shell is thin and white, while the other features are well shown in the engravings. As its name indicates, its home is in Alaska, reaching northward from Sitka.

Macóma sécta, the Giant Macoma, is shown in Figure 77. It is the largest and finest species of

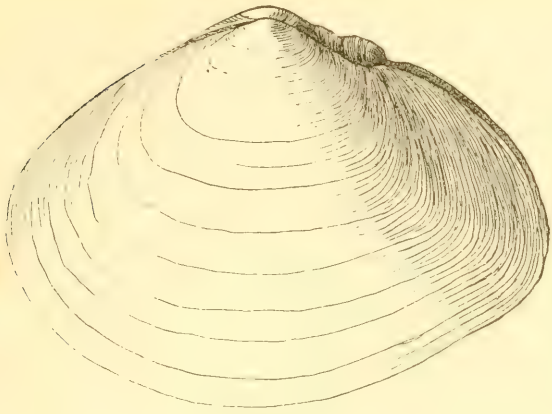


Fig. 77

the whole genus. The general form of the shell is oval, but the posterior end is suddenly contracted. Thin and glossy, with some epidermis around the edges. Pallial sinus large, ligament strong and broad, making a conspicuous external feature.

Macóma indentáta, Cpr., the Indented Macoma, is a southern shell resembling a small specimen of the last species, but the lowest edge of the shell, near the posterior end is indented and beaked.

A very pretty shell found far to the south is named *Metis alta,* Conr., the Yellow Metis, (Lutricola alta). The shell is round oval, wrinkled at the siphon end, and marked with fine but distinct concentric lines. Ligament area depressed. Whitish or brownish externally; inside glossy white, suffused with a bright yellow flush in fresh specimens. Length about two inches.

While the last shell was very pretty we now have one that far exceeds it in beauty, namely, *Sémele*

decísa, Conr., the Clipped Semele. The first name is that of the mythical mother of Bacchus, while the second refers to the short posterior end, which looks as if it had been cut off with a pair of scissors. The shell is nearly round, rather heavy, the ligament internal and lodged in an oblique pit, and the pallial sinus is high and oval. The outside of the shell is coarsely wrinkled, brownish in color. The interior, where the beauty resides, is finely polished, looking like bright porcelain, and is more or less tinged with purple, particularly around the edges. Grown specimens are two inches or more in diameter.

Sémele rúpium, Sby., the Rock Semele, is smaller, nearly circular, white, with a pink hinge-area. I have found pretty specimens as far north as Monterey.

Sémele púlchra, Sby., the Beautiful Semele, has a small, thin, oval shell, with crowded concentric sculpture and radiating lines at the sides. This is a southern species, but the variety *montereyi,* Dall, is found farther north, as its name indicates. It is less than an inch in length, oval, thin, ventricose, the beaks quite posterior to the middle of the shell; pallial sinus very large, being rounded, and expanded interiorly.

Sémele califórnica, Ads., the California Semele, is a southern species, very rare, the shell one inch long. It is the same as the yellow S. flavescens, Gould.

Sémele rubro-pícta, Dall, the Rose-painted Semele, is thick, convex, white, with rose rays outside, and marked with heavy, interrupted, concentric ridges and obsolete radial striation. Inside it is white or yellow, never purple. The surface is not granular. This is a southern species, found near San Diego. It is very probable that there are other species of this difficult genus, that are not yet described.

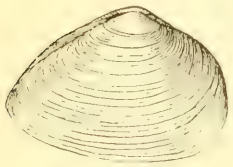


Fig 78

Cumíngia califórnica, Conr., the California Cuming-shell, Figure 78. It is somewhat triangular in outline, with the front rounded and the rear end narrower and slightly twisted. The lines of growth are very distinct, forming concentric ridges. The shape of the shell varies considerably in different specimens. Pallial sinus large, color white, length about an inch. From Monterey southward.

Cooperélla subdiáphana, Cpr., the White Cooper-shell, (Œdalia s.). This species has a thin, white, glistening shell, which appears quite swollen. The hinge-teeth are central, and the short ligament is situated almost between the prominent beaks. Length half an inch; southern.

Cooperélla scintillæformis, Cpr., the thin Cooper-shell, is another southern species. It has a very thin shell, about half an inch long, but less swollen than the last.

Córbula lutéola, Cpr., the Yellow Basket-shell, is shaped somewhat like a small Donax, and is well

marked with lines of growth. The ligament is internal, lodged in a small pit, and the pallial sinus is small. Valves rather thick, incurved at the edges, angled at one corner. Southern, only 8mm. long.

Neæra pectináta, Cpr., the Dipper-shell, is a very small affair, nearly globular, with about 12 prominent, radiating ribs. The posterior end is drawn out into a slender tube, so that each valve looks like a dipper. Southern, 6 mm. long.

We now come to the Myacidæ, a small family, but containing one of the most important species on the whole list, if we think of the mollusks only as food for man. *Mya arenária,* Linn., the Common Mya, or Rhode Island Clam, was known in Europe and on the Atlantic Coast long ago, and was highly esteemed as an article of food, whether it were fried, steamed, or made the basis of a chowder. It was unknown in San Francisco Bay until 1874, when a few specimens were discovered near Oakland, which were named Mya hemphilli, Newc., in honor of the veteran collector, Mr. Henry Hemphill. In a little time, however, its true nature became known, and conchologists realized that the Atlantic Mya had crossed the continent, doubtless with seed oysters from Chesapeake Bay, and had settled down in the western waters. Unlike the aristocratic oyster, which propagates but slowly with us, the more plebian clam began to fill the mud-flats on both sides of the bay with its burrows, and even ventured outside the Golden Gate and began its march up and down the coast.

Although not quite so delicious as the oyster, the Mya is an excellent food-mollusk, and is sold in San Francisco in immense quantities. Its domains are not fenced in, like the oyster fields, but it may be gathered by anybody who will take the trouble. Figure 79 gives a view of the inside of a left-valve, showing the spoon-like hinge-tooth, the muscle-scars, and the pallial sinus. The valves are rather thin and brittle; they gape at the ends, and the edges are covered with a gray epidermis. The common length of grown specimens is three inches.

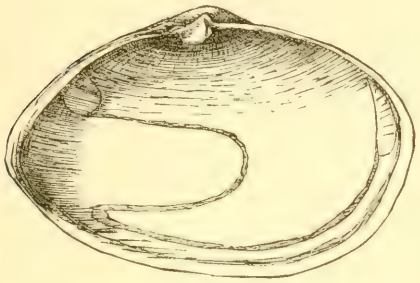


Fig. 79

Mya truncata, Linn., the Blunt Mya, resembles the last, but the siphon end is truncated, as if it had been chopped off. This species also lives in the Atlantic, and is reckoned as circumboreal, coming down on the west side as far as Puget Sound.

Cryptomya californica, Conr., the False Mya, lives all along the coast. The shell is elliptical, slightly gaping, nearly smooth, sometimes marked with faint lines. The sinus is small or obsolete, and the right valve is provided with a large, spoon-shaped hinge-tooth, on which is the ligament. Shell rather thin, white, with ashy epidermis; length an inch or more.

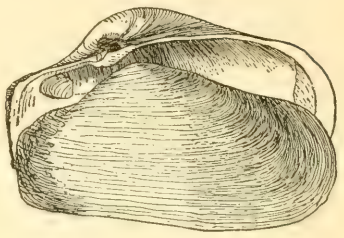


Fig. 80

Figure 80 gives us a good idea of the shell of *Platyodon cancellátus,* Conr., the Flat-tooth Clam. It closely resembles the Mya, but its broad hinge-tooth is not so large; moreover the valves are much thicker and firmer, and are greatly bulged. The shell is white or gray, and the length is two or three inches. I found them abundant at Bolinas, and they reach as far south as San Diego.

The shell of the little *Saxicáva ártica,* Linn., the Arctic Saxicave, is small, thin, wrinkled and irregular. The beaks are near the front of the shell, which is abruptly terminated. Ligament small, external, behind the beaks. Color ashy white, length from 6 to 12 mm. It is found on the roots of kelp, and in similar situations. By some this is considered but a variety of *S. pholádis,* Linn., a small species which has been dredged in San Pedro Bay. *Saxicáva rugósa,* Linn., the Rough Saxicave, occurs in the far north, and also as far south as San Diego. I believe all three are but varieties of one species.

Panopæa generósa, Gld., the Giant Panopæa, (Glycimeris generosa), is shown in Figure 81. This huge mollusk, which lives chiefly in northern waters, is the king of all the burrowing clams. A pair of shells, kindly sent me from Puget Sound,

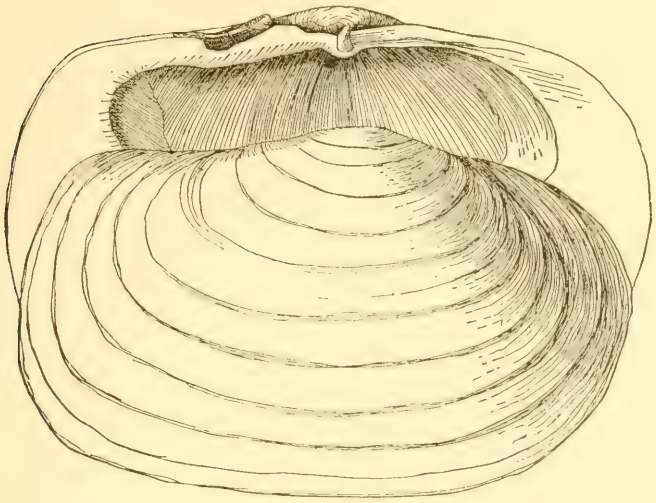


Fig. 81 x $\frac{1}{2}$

measure seven and a half inches in length. The creature burrows to a depth of two feet or more. The valves are oblong, rather flat, and are marked with decided lines of growth. They gape widely where the siphons enter. The left valve has a hinge-tooth like a sharp horn. The shells are dull white without, but pearly and shining within. In the north this great creature is sometimes known by the singular name of "Goeduck."

Panómya ámpla, Dall, the Ample Panomya, is an Alaskan shell, coarse, chalky white, with a black, tarry epidermis which falls off. The shell is nearly square, and is some three inches across. It gapes, and does not fully cover the living animal.

The mollusks which are now to be considered belong to the Solenidæ, and include what are popularly known as the Razor-shells, because most of them are long and narrow and resemble somewhat in shape the handle of a razor. Most of them are covered with a glossy epidermis, making them look as if they had received a coat of varnish. Some of the names refer to bean-pods, which the shells resemble even more than they do razors.

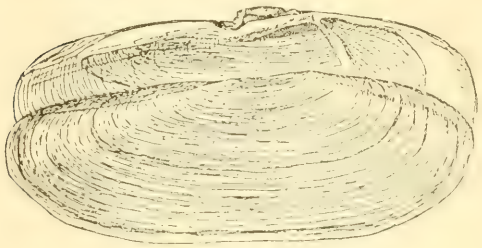


Fig. 82 x $\frac{1}{2}$

Siliqua pátula, Dixon, the Flat Razor-shell, (Machæra patula), is shown in Figure 82. Beautiful examples of this shell are found on the Oregon coast and farther north, though it is not wholly absent from the south also. Broken shells used to be washed up on the Cliff House beach in San Francisco.

As this shell was figured long ago I will quote its description from the words of the discoverer, Capt. George Dixon, who wrote an exceedingly interesting book entitled "A Voyage Round the World," which was published in London in 1789. This is said by Dr. P. P. Carpenter to be probably the "first description on record of mollusks from the Pacific shores of N. America by the original collector."

"At the mouth of Cook's River are many species of shell-fish, most of them, I presume, nondescript. For a repast our men preferred a large species of the Solen genus, which they got in quantity, and were easily discovered by their spouting up the water as the men walked over the sands where they inhabited: as I suppose it to be a new kind I have given a figure of it in the annexed plate. 'Tis a thin brittle shell, smooth within and without: one valve is furnished with two front, and two lateral teeth; the other has one front and one side tooth, which slip in between the others in the opposite valve: from the teeth, in each valve, proceeds a strong rib, which extends to above half-way across the shell and gradually loses itself towards the edge, which is smooth and sharp. The color of the outside is white, circularly, but faintly zoned with violet, and is covered with a smooth yellowish-brown epidermis, which appears darkest where the zones are: the inside is white, slightly zoned, and tinted with violet and pink. The animal, as in all species of this genus, protrudes beyond the ends of the shell very much, and is exceeding good food."

There are several varieties of this species, including var. *alta,* B. & S., which lives in the far north; it is short and broad, with a straight rib. Var. *nuttallii,* Conr., is found in Alaska and also in California as far south as Monterey; the shell is very straight, brilliantly polished, and has a very oblique rib.

Siliqua lúcida, Conr., the Bright Razor-shell, lives from Monterey to San Diego, and, according to Dr. Dall, it was confounded by Carpenter with the young of S. nuttallii. The shell is small, fragile, and has a short, narrow, and nearly perpendicular rib, or callus.

Fig. 83

Sólen sicárius, Gld., the Blunt Razor-shell, shown in Figure 83, is short, slightly curved, and truncated in front as if it had been chopped square off. White, with a glossy, yellowish epidermis. This species ranges from Vancouver Island to San Pedro, Cal.

Sólen rosáceus, Cpr., the Rosy Razor-shell, lives only in the south. It is two inches long and less than half an inch wide, and resembles a small, flattened tube. The shell is straight, rosy white in color, and is covered with a glossy, horn-colored epidermis.

Ensis califórnicus, Dall, the California Razor-shell, is a rare shell, found from Monterey southward. It is delicate, slender, and curved.

The members of the Mactridæ, which we are now to consider, may be distinguished by the triangular pit for the cartilage, which is situated in the midst of the hinge-teeth. The shells are mostly quite thin, with sharp edges, and they are often partly or wholly covered with a thin epidermis.

Máctra nasúta, Gld., the Beaked Mactra, resembles Figure 84, a figure which shows the general internal appearance of several species of this group. The shell is of moderate size, and is widely scattered along the coast.

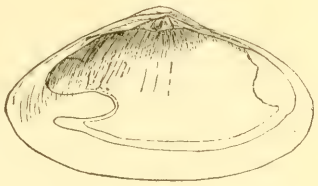


Fig. 84

Máctra califórnica, Conr., the California Mactra, (Standella nasuta), has a rather small shell, somewhat depressed behind the furrowed beaks, which are near the center of the shell. An inch to an inch and a half in length.

Máctra dolabrifórmis, Conr., the Mattock Mactra, occurs from San Diego southward, and so scarcely comes into our list. The shell is compressed; and is polished white under a dull brown epidermis. In the hinge-area the ligament is separated from the cartilage pit by a shelly plate. This fine shell grows to a length of three and a half inches.

Spísula polymýma, var. *alaskána,* Dall., the Alaska Mactra, resembles M. californica, but is larger. It is found about Icy Cape, but comes southward as far as Neah Bay.

Spísula catillifórmis, Conr., the Dish-shell, (Standella Californica), is shown in Figure 85. This is the fine large shell that is said to exist from Neah Bay to San Diego. I have gathered large specimens about Long Beach, Cal. The shell is

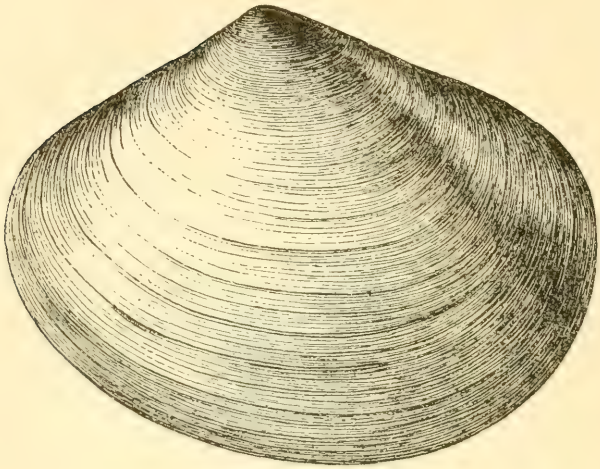


Fig. 85, x $\frac{3}{5}$ †

thin, whitish, covered with a gray, wrinkled epidermis. The cartilage pit is large, and triangular in shape. The pallial sinus reaches nearly to the middle of the shell. These great Dish-shells sometimes reach a length of over five inches, and can hardly be mistaken for any other species, except the next.

Spisula hemphillii, Dall, Hemphill's Mactra, is a rare species occurring in San Pedro Bay and San Diego. It resembles the last species, but grows even larger, a specimen before me measuring six inches in length. The white shell is covered with a brown periostracum, which in young shells is prettily lined, and almost glossy, while at the posterior end it is decidedly ridged and wrinkled. The front end of this shell is narrower than that of

† From The Nautilus, vol. vii, p. 138.

the last species, and the pallial sinus is smaller.

Spísula falcáta, Gld., the Falcate Mactra (Standella falcata), has a shell of moderate size, resembling Mactra californica, but it has a smaller sinus and a narrower anterior end. The shell is glossy, thin, and rather flat. It is found in British Columbia, but extends far southward.

Labiósa (Ræta) undulàta, Gld., the Wavy Ræta, is a very distinct, though rather rare southern species. The hinge resembles that of the Mactras and shows the triangular pit plainly. The outline is not very different from Figure 85, but the shell is very thin, not merely at the edges but throughout its whole extent, and is very decidedly marked with concentric ridges, which even appear on the inner surface. Near the beaks it is much inflated. Externally it is light brown or ashy, and when at all thickened the interior is white. Three or four inches is the common length.

The last member of this group has the largest shell of all, sometimes reaching a remarkable length, while specimens of six inches are not uncommon. Its name is *Trésus nuttállii,* Conr., the Washington Clam, (Schizothærus n.). This huge clam burrows deeply in the mud, and is therefore rather hard to capture. It makes an excellent chowder, and a very few clams are enough for a large family.

The shell is oblong, bulged, rather thin, and it gapes widely at the end where the long siphons

pass out. The sinus, as might be supposed is very broad and deep. The hinge-teeth are small, while the cartilage pit is large and deep. The white shell is covered with a thin epidermis. This species delights in muddy bays, and is found along the whole coast.

Passing now to a very different group of shells, we come first to *Thrácia cúrta*, Conr., the Short Thracia. In form and markings its shell resembles Figure 42, though it is somewhat oblong and also wrinkled at the rear end of the valves. Ligament external, hinge-teeth small, sinus shallow, length from an inch to two inches. *Thracia undulata*, Conr., the Wavy Thracia, also called *plicata*, is a rare species that is larger and thinner than the last.

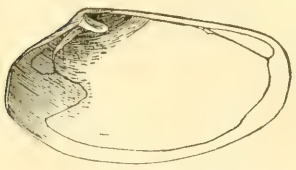


Fig. 86

Figure 86 represents the inside of the left valve of *Periplóma planíscula*, Sby., the Silver Lantern-shell, (P. argentaria). This is a pretty species, easily recognized by its peculiar spoon-like hinge-teeth. Oblong, beaks near the posterior end, sinus small, right valve inflated, left valve flattened. White, smooth, with fine lines of growth, silvery within. An inch or two long; southern.

Periplóma discus, Stearns, the Round Lantern-shell, is well shown in Figure 87. This fine species was discovered at Long Beach, Cal., not many years ago, and for a time specimens were very rare. The shells are white, exceedingly thin and fragile, almost circular, though with one square corner. The diameter of large specimens is nearly two inches.

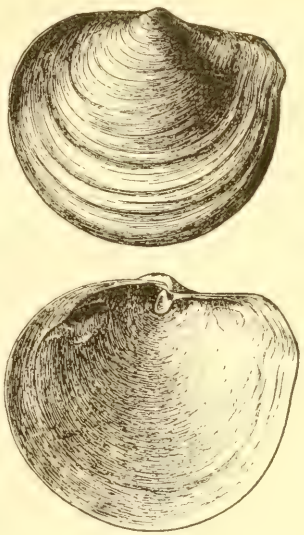


Fig. 87, (*)

Fig. 88

A delicate little shell, of which Figure 88 represents a large specimen, found at various points along the coast and also in San Francisco Bay, is named *Lyónsia californica*, Conr., the California Lyonsia. The shell is bulged at one end, while at the other it is narrow, thin and crooked. The outer coat shows many concentric striæ, but this is easily rubbed off, revealing the inner layer, which is quite pearly.

Lyonsiélla alaskána, the Alaska Lyon-shell, is shown in Figure 89. The specimen was dredged from deep water in the Gulf of Alaska. The figure is somewhat enlarged, but it shows the main external features of this thin and delicate shell.

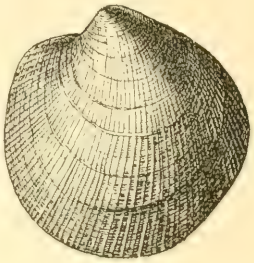


Fig. 89, x $\frac{3}{2}$ (*)

Mytiliméria nuttálli, Conr., the Sea-bottle Shell, is a singular mollusk, which may be found imbedded in a colony of compound Ascidians, or Sea-bottles. The shell is very thin, white, and is covered with a brown epidermis, and there is an oscicle under the hinge. In shape the shell resembles an inflated bladder, with the spiral beaks at one end. Its height is about one inch. This is a singular instance of a thin shell deriving protection from the bodies of the animals by which it is concealed.

Our next species is named *Entodésma saxícola,* Baird, the Rock Entodesma. It is a singular creature, living in holes of various shapes and taking whatever form seems most convenient. The shell is somewhat oblong or pear-shaped, bulging at the hinge end, gaping beneath, and prolonged around the siphons into an irregular process consisting chiefly of epidermis. Internally the shell is white, while externally it is very rough and unsightly, being partly covered with a brown periostracum. When dry it is usually more or less bent or broken, owing to the unequal shrinkage of the hard parts

and the covering. A large oscicle, or shelly plate, covers the hinge internally. This is especially a northern species.

The southern shell, *Entodésma inflàta,* Conr., the Puffed Entodesma, resembles the last, but is smaller, thinner, and more irregular, and is composed largely of epidermis. It is narrow in front, wider and thinner behind.

Verticórdia novemcostàta, Ad. & Rve., the Nine-ribbed Verticordia, has a minute shell, only 4 or 5 mm. high. In outline it is nearly square, and from the beak near one corner run about nine prominent ribs. The shell is bright pearly within; southern.

Clidióphora punctàta, Cpr., the Dotted Pandora, is a rare shell of very unusual shape, somewhat oblong and beaked. Instead of being inflated it is very flat and compressed. The valves are thin and silvery, while within they are marked with many little pits or dots. It is somewhat over an inch in length. From Victoria to San Diego.

The last family of the Pelycepods is that of the Boring-shells, of which there are two divisions. The first of these includes the Piddocks, which bore their way into clay, shell, or rock; while the second division, the Teredos, work chiefly in wood.

Phólas pacífica, Stearns, the Western Piddock, is the first species to be mentioned. The shell is thin and delicate, long and cylindrical, marked with wavy, concentric ridges and faint radiating lines. The sculpturing is not sharply divided into two sections, as it is in some of the following

species. Within each valve, beneath the hinge, is a slender spoon of shell, very narrow and delicate; its use is not fully known. On the outside, just above the ligament, is a long projecting plate with straight sides. This auxiliary valve, as it is called, is curved in front and straight behind. The shells gape widely at the ends. The length of the white valves is about two and a half inches. The creature burrows in mud and clay.

Fig. 90

Penitélla pénita, Conr., the Common Piddock, (Pholadidea penita), is shown in Figure 90. While it is often much smaller than the picture, specimens are sometimes found that are more than twice as long. Like the other Piddocks, the forward part of the shell is rounded and rasplike, while the latter part is narrow and smooth. A triangular plate covers the hinge-area, and the valves end in epidermal flaps or scales. It is commonly found in burrows which it constructs for itself in the softer rocks which occur here and there all along our coast. In young specimens the forward end gapes widely to allow the strong foot to press against the side of the burrow and thus assist in turning the shell, whose sharp points wear into the rock, though just the method by which it bores is not clearly known. As it grows older it seems to realize that it has gone far enough, and closes the front of the opening in the valves with a wall of shell, making them appear very round.

Pholadídea párva, Tryon, the Little Piddock, is a very small species, which some consider as a small variety of the last. It burrows into Haliotis shells.

Pholadídea ovoídea, Gld., the Oval Piddock, is a small, oval form, resembling in shape a small Z. crispata, whose forward end is filled out with curved shell.

Pholadídea darwínii, Sby., Darwin's Piddock, (Netastomella d.), is a little borer found in rocks. The front of the shell is open and circular, while the latter part is prolonged into a narrow, flattened tube, shaped like a duck's bill. The shell is marked with striæ, and is divided into two parts by a sudden constriction. Whitish; about half an inch long.

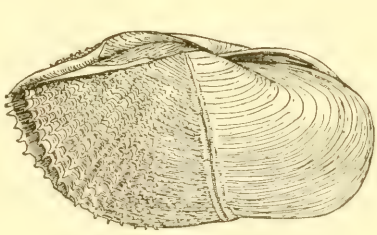


Fig. 91

Figure 91 gives a good idea of the shell of the Rough Piddock, *Zirphaéa crispáta, Linn.* This fine borer is able to force a tunnel into the hardest of blue clay, doubtless by means of its sharp rasp. There is no accessory plate over the hinge-area in this species, but it is protected by a membrane, and in front of the umbones the valves are reflexed. The shell is thin, white, and very hard, and the length is from two to four inches. This species is widely distributed, being found in both great oceans.

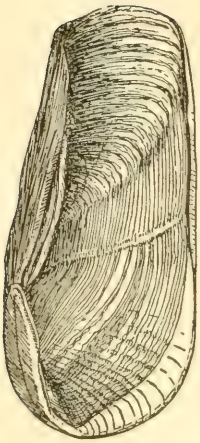


Fig. 92

The great California Piddock, *Parápholas califórnica,* Conr., is represented in Figure 92, which well illustrates its main features. The upper end of the shell is mainly composed of large scales of epidermis. Near the line of union of the two valves there are accessory plates, long, straight, and smooth. The shells are white, rather delicate, and are three or more inches in length. The rocky dust which the animal obtains in the process of excavation he uses in building up a strong, conical chimney, which protects the siphons.

Martésia intercalláta, Cpr., the Shell-boring Piddock, is a very small borer from the southern fauna which is sometimes found in large shells like that of the Haliotis. Its presence sometimes disturbs the occupant of the shell, especially if its burrow has been carried nearly through the pearly lining, in which case a knob is built up as a defence against the intruder. The valves of the little borer gape widely in front, and the entrance to its burrow is quite small.

There is a very singular and very destructive mollusk, which lives especially in San Francisco Bay, and which is named *Xylótria setácea,* Tryon, the Teredo, or Ship-worm, (X. pennatifera). Its great end in life seems to be to bore as long a hole as possible; not for the reason that it desires the

wood for food, but simply for the fun of the boring.

The young of this mollusk, like those of many others, are free swimmers, quite unlike the parents. After a brief and sportive life in the water he finds a post or a floating piece of wood and begins to bore. As he advances, he lines the hole with a tube of shell, and if he nears another hole he turns to one side and bores on through undisturbed wood. Thus it happens that the timbers of a wharf may appear perfectly sound, when, in fact, they are completely honey-combed.

The valves of the shell are at the very front of the tube, and are nearly spherical in shape. They gape widely at both ends. The front of the shells is very beautifully sculptured, though the markings are often so fine that a microscope is needed in examining them. There are also two oar-shaped, shelly appendages, which close the external opening of the burrow and perhaps perform other duties. The globular shell of the Teredo is about half an inch in diameter, and the pens or oars are some two inches in length.

Xylótria stutchbúrryi, Jeff., the Little Teredo, has a very small shell, of which the valves are white and triangular, while the pens are minute and club-shaped.

This closes our descriptions of the two-valved mollusks. Very much concerning the details has been left unwritten, and for every observer there remain plenty of interesting facts, which are only waiting for some discoverer.

CHAPTER VI

UNIVALVE MOLLUSKS

Fig. 93

A strange little shell is that shown in Figure 93, and a fairy tale it could tell of the life of its little inhabitant. Shaped like the tusk of an elephant, pure white and open at both ends, it differs widely from all other kinds of shells. The name of this species is *Dentálium preciósum,* Nutt., the Precious Tusk-shell. It has also been called D. indianorum, and with good reason, for in former years the Indians used to gather them from the little bays on the west coast of Vancouver Island and string them for wampum. The Tusk-shell lives partly buried in the sand. An inch is perhaps an average length for shells of this species.

Dentálium neohexágonum, S. & P., the Hexagonal Tusk-shell, is the common species of southern California. Sometimes the shells are two inches in length, and as the name indicates, a cross section would be six-sided. The shell is thin, white, curved and angled. This species was called D. hexagonum in West Coast Shells, but that name is found to belong to an oriental species.

Dentálium semistriátum, var. *semipolítum,* B. & S., the Ornamented Tusk-shell, is a small species that lives in the south. Its shell is thin, white, and ornamented with numerous fine ridges run-

ning from the apex two-thirds of the whole length. The aperture is circular.

Cádulus quadrifíssus, Cpr., the Four-slit Tusk-shell. This very large name belongs to a very small shell, only half an inch long, which may be easily distinguished because the small end is cut by a little cross, composed of four slits.

Cádulus hepbúrni, Dall, Hepburn's Tusk-shell, is found near the city of Victoria, B. C. It is only 11 mm. in length, and is polished, white, and nearly straight. *C. tólmiei,* Dall, Tolmie's Tusk-shell, is found with the last species, but is more curved, and rapidly tapers. The shell is smooth, polished, and is 12 mm. long. *C. abérrans,* Whiteaves, the Wandering Tusk-shell, is the only other species of this genus found in the same locality as the last two. Its shell is larger and more curved.

The Pteropods are mostly deep sea creatures, which live near the surface, and they have been well called "Sea-butterflies." The shells are very thin and light, and in modern times at least they are quite small. A few have been found on our coast, notably, *Cavolínia tridentáta,* Forsk., the Trident Sea-butterfly. This little shell is thin, hollow, horn-colored, shaped like a small button with three small projections or points at one end, of which the middle one is the longer. It has come ashore in southern California, and perhaps elsewhere.

A few years ago I visited the pretty little town of Bolinas, situated on the first bay to the north of the Golden Gate. From the shore there runs out

a ledge of rock far into the ocean, which is commonly known as Duxbury Reef. One morning when the tide was low I went far out on this reef, which forms a fine place for the home of many creatures. Turning back the masses of olive-green seaweed, I found a considerable number of mollusks with shells like the one shown in Figure 94. It is not a very common species for California, but is more abundant in the north.

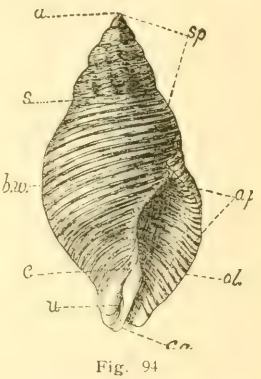


Fig. 94

The shell of a full-grown specimen is an inch and a half long. It is spindle-shaped, that is, it is largest in the middle and tapers towards each end. Various parts of the shell have received names, and as this is the first species which we are to consider which belongs to the great class of the Gasteropods, we will now consider these names. The Gasteropod shell is really a long tube, coiled in a spiral form. This may not seem so evident in this species as in certain others, but it is the plan of the shell, nevertheless, and will help to explain many troublesome questions. The opening to this tube is called the aperture, and is marked *ap* in the figure. As you face the shell you notice that this aperture is on the side next to your right hand. This is true of most shells, which are therefore called dextral, while a few, which turn the other way, as in Fig. 142, are called sinistral shells.

The upper part of the shell is known as the spire, marked *sp,* of which the very top, *a* is the apex, while each turn of the spire is a whorl, the largest of which, *b. w.,* is the body whorl. The spiral groove between the whorls is the suture, marked *s.* The central post, *c,* is the columella, while the central opening, *u,* is the umbilicus. The little open tube marked *ca* is called the canal, and the outer edge of the aperture, *o. l.* is the outer lip. The inner lip, in this specimen, is grown to the columella and does not appear, though in some shells, as shown in Fig. 194, it is very evident. Many shells have no canal, and in most instances we judge that the animal which has such a shell is herbivarous, while those with canals are carnivorous. Line of growth run parallel to the edge of the outer lip, while spiral lines run around the shell and cut the lines of growth. Varices are enlarged portions of the shell, parallel to the lines of growth, while the operculum is a kind of door that the animal pulls up to the aperture, after he has withdrawn into his shell. With these few simple definitions, we are ready to describe almost any of the numerous shells that we are to consider in the remaining part of the book. The name of the species whose shell is shown in Figure 94 is *Chrysódomus dírus,* Rve., the Dark Chrysodome. The shell is of a dark liver color, though this is often obscured by an ashy powder, giving it a dingy appearance.

As we have considered this type of shell out of its natural order, we will now turn our attention to what is properly the first species of the great

class of the Gasteropoda, named *Actæon punctocælátus*, Cpr., the Barrel-shell, (Rhextaxis punctocælata), Figure 95. It is a pretty little thing, which is sometimes found washed up on the beach, and at certain times of the year it may be found alive in the tide-pools, where it has gone to lay its eggs. Its length is about half an inch. There is a little fold on the columella. Its surface is pure white, with two series of spiral bands, narrow and black. I have gathered this species alive on Dead Man's Island, near San Pedro.

Fig. 95

Actæon páinei, Dall, Paine's Actæon. This is one of the new species recently secured by Messrs. Lowe and Paine, while dredging near Avalon, Santa Catalina Island. The length of the shell is 8 mm., and it may be distinguished from the last species by its short spire, stouter form, and the absence of color bands.

Tornatina culcitélla, Gld., the Pillow Lathe-shell, is shown in Figure 96. It has a cylindrical body, as if it had been turned in a lathe, and it is dainty enough for a fairy's bolster. The color is brownish, and fresh specimens are banded with numerous microscopic striæ. Large specimens are nearly an inch long.

Fig. 96

Tornatina hárpa, Dall, the Harp Lathe-shell, is smaller, being about six millimeters in length. The color is white, and it is easily distinguished by the longitudinal grooves and lines on the upper half of the last whorl.

Tornatína exímia, Baird, the Excellent Lathe-shell, resembles T. culcitella, though it is smaller; but it differs in having a more depressed spire, a longer and narrower aperture, and a smaller plait on the columella. It is found in Puget Sound, and also at San Diego.

Tornatína cerealis, Gld., the Grain Lathe-shell, has a minute white shell, less than a quarter of an inch in length. It is quite solid, and has a spire rounded at the apex.

Cylíchna álba, Brown, the White Cup-shell, is another of these small species of shells which resemble little rolls of cloth. This species has a white shell, 10mm. long, which is somewhat cylindrical, and tapers towards both ends. It occurs in southern California, and also on the Atlantic shores.

Vólvula cylíndrica, C'pr., the Roll-shell resembles the last species, but is somewhat flattened in the middle, and has an extended umbilical point. "Like a grain of rice, pointed at one end." (C'pr.)

The fine shell shown in Figure 97 is named *Búlla gouldiána,* Pilsbry, Gould's Bubble-shell, (Bulla nebulosa). It is thin, polished and mottled, resembling a large bird's egg. The spire is depressed, or more strictly speaking the body-whorl is elevated above the original spire. This species lives in the south. I have gathered them abundantly at San Pedro,

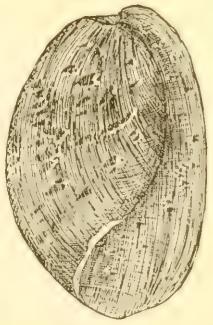


Fig. 97

when the tide was low. The shell is so delicate that it is almost impossible to remove the animal without injuring the inner parts of the shell. Fortunately excellent specimens may be found, almost fresh, from which every trace of animal matter has been eaten by little crabs and similar creatures. The shell is sometimes wholly brown, but in the finest specimens it is mottled with white and yellow clouds.

Haminea vesícula, Gld., the White Bubble-shell, is shown in Figure 98. The shell is not strictly white, however, unless it is bleached, but when fresh it is of a pale greenish yellow. It is very thin and fragile, and can easily be crushed by the fingers. And yet its inhabitant is not strictly a vegetarian, but devours small mollusks and crabs that happen to come to its home, which consists of muddy places along the shore of the ocean near the mouths of rivers. It has a powerful gizzard armed with teeth to crush any hard morsels that it may have swallowed. The figure represents a rather large specimen. You will notice that the aperture is extremely large, the spire depressed, and the whole shell quite like a bubble.

Fig. 98

Haminea virescens, Sby., the Green Bubble-shell, is smaller than the last, and has a very short body-whorl, while the outer lip is greatly extended. The animal which it is supposed to protect is much larger than the shell, however, and its delicate, greenish covering can give it but a scant cov-

ering. This species is found sparingly upon mossy rocks on the southern coast.

In 1863 three large specimens of *Aplysia californica*, Cooper, the California Sea-hare, were reported as found on San Pedro beach after a storm. One of them was fifteen inches long and five inches wide. Their stomachs were full of seaweed. The sea-hares are singular creatures, being long and slug-like, with a distinct head, while the rudimentary shell is concealed by the mantle. Notwithstanding their somewhat offensive appearance they are perfectly harmless, and may be handled with impunity.

Pleurobránchus californicus, Dall, the California Side-gill, also comes from San Pedro. The animal is oval and flattened and has a distinct head. The shell is a thin, white scale, concealed in the mantle. The gill is single, free at one end, placed on the right side between the mantle and the foot. The animal is waxy white in color, about an inch long, while the little shell is half of that length.

Somewhat similar in their anatomy to the last few species are the Sea-slugs, which form a great group of naked mollusks. While they have no shells, they are far from being without interest. Their bodies are often very brilliantly colored, so that when they are alive and swimming they are among the most beautiful objects of the sea. You will find them on seaweed at low water, looking like little lumps of soft tissue without form or beauty; but when put into a jar of seawater they

will extend their tentacles and expand their flower-like gills, and display their fine colors in all their glory. Some are white with scarlet trimmings, others are yellow with brown rings, while still others have brilliant fringes of various hues.

They are mostly small, even when extended, and usually measure but an inch or two in length. As they cannot be preserved except in alcohol or some similar fluid their beauty is apt to be destroyed; hence they can be satisfactorily studied only at the seaside. We give a brief description of one of the most common species.

Dóris montereyénsis, J. G. Cooper, the Monterey Doris, has a rather large, slug-like body, sometimes reaching a length of three inches, though commonly much smaller. The color is pale yellowish, with scattered black spots, and the surface is sometimes rough tuberculate. The branchial rays, or gills, form a crown-shaped expansion on the posterior third of the back of the animal. It may be often found at low tide, in little pools or among patches of seaweed.

CHAPTER VII

AIR-BREATHERS

For a while we must now leave the sea and all the plentitude of life that finds its home along the shores of the ocean, and search for the molluscan forms that live upon the dry land. By their very nature, however, we need not expect to find them where they have no chance to obtain considerable moisture, for in dry climates they are liable to perish, even if once introduced. So we will search for them in the shade of forests, around springs and brooks, and in damp, dark places where the sun seldom shines. For many of them have a strong aversion to sunlight, especially if it is bright, and so they come out of their lurking places and secure their food in the night, and when morning comes they have disappeared.

Most of them breathe by means of a simple lung, or air-sack, which opens on the right side of the body, as is plainly shown in the picture of the yellow slug, Figure 102.

Ffg. 99

Figure 99 represents a view of an unusual form of *Selenítes vancouverénsis,* Lea, the Northern Selen, (Macrocyclis vancouverensis). The unusual feature may easily be seen, for the figure represents the shell as sinistral, while most if not all of the actual specimens are dextral. Seen in

a looking glass, however, it appears quite correct. Some specimens grow to a considerably larger size. The epidermis is yellowish green, while the interior of the shell is white. There are five whorls, the last one being flattened above, at the aperture. A dark colored variety is found in Alaska. As the name indicates, this species makes its home about Puget Sound, but it extends down to California, and eastward to Idaho and Montana. The var. *keepi,* Hemphill, is a perfect minature of the species and is reckoned as an extremely small variety of the same. It is found in the Contra Costa hills, back of the city of Oakland.

Selenítes sportélla, Gld., the Sportive Selen, (Macrocyclis sportella), is decidedly smaller than the normal form of the last species. Its color and shape are similar, but it is marked by sharp growth-striæ. The difference is most plainly seen on the base of the shell which in the last species is smooth, while in this it is decidedly striated. For localities refer to the general "List of Species," near the close of the book.

Figure 100 shows us a basal view of *Selenítes voyána,* Newc., Voy's Selen, (Macrocyclis voyana). Notice the wide umbilicus and the triangular aperture. The shell is thin, triangular, and of an olivaceous horn-color. California coast.

Fig. 100

Selenítes hemphílli, W. G. B., Hemphill's Selen, is a small species, half an inch across, thin, glossy, marked by irregularly impressed lines of growth, without any trace of revolving lines. This shell is also known as Circinaria hemphilli. Oregon.

Selenítes duránti, Newc., Durrant's Selen, is a little affair, 4mm. across, widely umbilicated, flattened, light yellowish brown, striated. Var. *cacláta,* Mazyck, is about the same size, but has very coarse, rough, irregular ribs, seen best from the under side. California coast and islands.

It may be well to remark that all the Selens are said to have very vigorous appetites, and they should not be placed with other snails, for if they are thus confined, the other snails are apt to disappear.

The members of the genus Limax are true slugs, i. e., they are naked, crawling mollusks, looking like snails without shells. It is true that they have rudimentary shells concealed by their mantles, but these are not easily observed. Several of our species have come over from Europe, and are settling down in America more to their satisfaction than to ours. Among the various species we mention first, *Límax máximus,* Linn., the Great Limax. This creature grows to a length of four inches. In color it is light brown or ashen, with rows of round spots alternating with black stripes. It has been reported from San Francisco, Los Angeles, and other coast cities.

Límax agréstis, Linn., the Field Limax, is another unwelcome immigrant, now thoroughly naturalized. Its color varies from whitish to black, through various shades of yellow and amber. It is usually about an inch long, but when fully grown is nearly twice that length. The upper side of the animal is marked with longitudinal, shallow furrows, darker than the general surface,

while between these are little tubercles, giving it the appearance of mosaic work. When touched it secretes a glutinous mucous. It is liable to become a great pest in gardens, doing most of its ravages in the night season.

Límax campéstris, Binney, the Lawn Limax, is closely related to the last species, but is smaller, more semi-transparent, and does not so readily secrete mucous. It is about an inch long, the body is cylindrical, the mantle oval and fleshy, the back tubercled and furrowed, the foot narrow and whitish. It has no spots or markings, and varies in color from amber to black. I have sometimes seen great numbers of these little black slugs upon the lawn at Mills College.

Límax héwstoni, J. G. Cooper, Hewston's Limax, is found in San Francisco, Los Angeles, and other places. It is a dark colored slug, two inches long, the back being strongly ridged and higher than the front of the body. The height of the body is twice the width of the foot, the base of which is whitish in color.

Límax montánus, Ing., the Montain Limax, is a stout, blunt, bluish-gray slug, an inch or more in length, found in Montana and Colorado.

Vitrína pféifferi, Newc., Pfeiffer's Glass-snail, is a little mollusk resembling a slug, but with a small, shining, greenish white, spiral shell of three whorls, 5mm. in diameter. It is generally found at high altitudes. The aperture is large, the lip thin, and the shell too small to admit the whole animal.

Several species of the genus Zonites now follow in our train of study. They are all small, having spiral shells, usually with rounded whorls and an open umbilicus.

Zonites cellárius, Müll., the Cellar Zonite, is a European species, but it has become widely distributed, even on the Pacific Coast. The shell is very much depressed, thin, fragile, and pellucid; the epidermis is greenish yellow, polished, and the base is rounded. The little snail which inhabits this shell is of a light blue color, very pretty, and quite active. It is a snail that follows civilization, and delights to live in cellars and damp places about buildings. The diameter of the shell is from 6 to 12mm. The larger variety is classed by some as *Zonites draparnaldi,* Beck.

Zonites arbóreus, Say, the Bush Zonite, has a spire of four or five whorls, so much flattened that the shell appears nearly like a circular disk. Shell smooth, amber-colored, very thin and almost transparent. Its diameter is 3 to 4mm. This species, which hides under leaves and among bushes, inhabits many parts of North America.

Zonitóides pugeténsis, Dall, the Seattle Zonite, is represented in Figure 101, very greatly enlarged, the real diameter being only 1.5

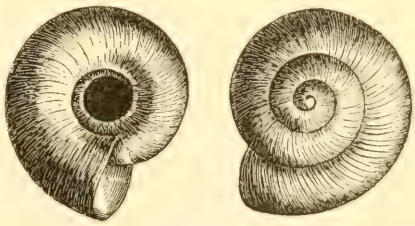


Fig. 101, x $\frac{1}{1}^{8}$ (*)

mm. The little shell was collected under leaves, near Seattle, by Mr. P. B. Randolph. It is of a dark reddish brown color, with silky luster.

Pristolóma lánsingi, Bland, Lansing's Zonite, is found in damp, moist places under leaves, in Oregon and Washington. The little shell is scarcely 3mm. in diameter, but it has five or six whorls, a rather elevated spire, but no umbilicus. The lower end of the narrow aperture is almost immediately beneath the apex. In appearance it is shining and dark horn-colored.

Pristolóma steárnsi, Bland, Stearns's Zonite, has a similar range, but reaches into Alaska. It resembles the last species, but is more elevated, more striate, and has seven whorls. Its diameter is 4mm.

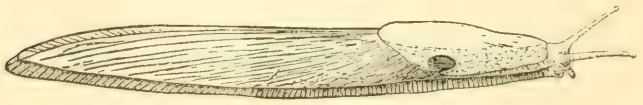


Fig. 102, x $\frac{1}{2}$

During the months when rain falls on the Pacific Coast a stranger is apt to be startled by meeting a few and perhaps many specimens of a yellowish slug of remarkable size, but old residents are used to them and not at all disturbed, though very few express any decided appreciation for the slippery things. In damp and shady places they are active all the year, though in the time of summer drought they are seldom seen in the fields. A picture of a half grown specimen is given in Figure 102. They frequently grow to a length of six inches, and look as if they were exceedingly

well fed. While speaking of food we may remark that they are remarkably fond of orange peel, and will be pretty sure to find a piece if it is left near their haunts, a fact indicating that they have a keen sense of smell. They are also fond of milk.

The name of this species is *Ariolimax columbiánus,* Gld., the "Great Yellow Slug." Occasionally a specimen is found that is partly covered with large, dark spots, but at best it is only a spotted form of the main species. A variety *stramineus,* Hemphill, of a light straw color, is described from Santa Cruz Island.

Two other species, *Ariolimax californicus,* J. G. Cooper, and *Aphallárion búttoni,* Pils. & Van., cannot be readily distinguished from A. columbianus by external characteristics, though they differ internally, particularly in the genetalia. Proper references for their extended study are made in the List.

Ariolimax níger, Cooper, the Black Slug, has a body long and narrow, blunt in front and tapering but little behind. When crawling, the animal is some two inches in length, but when at rest, as it may be found under old boards and in similar places, it is so contracted that it is hardly one inch long. Its color is quite dark, sometimes being nearly black, especially on the upper surface of the body; but I have found specimens which are very much lighter, almost an ashy gray. This species is common in central California.

Ariolimax hemphílli, W. G. Bin., Hemphill's Slug, is a small, slender, flesh-colored slug, with a

pointed tail, which was collected at Niles, Cal., though it probably lives in the neighboring parts of the Santa Clara valley.

Hemphíllia glandulósa, Bl. & Bin., the Hemphillia, is a curious little mollusk that lives in Oregon and Washington. When extended it is an inch or two long, but on its back is a hump, and on the hump is a shell, brownish, flattened, and scale-like, one fifth the length of the animal. The color is smoky white, with dark brown blotches, running from the mantle to the foot.

Bínneya notábilis, Cooper, the Binneya, is a curious Mexican form found on Santa Barbara Island. The shell is ear-shaped, light, thin, and horn-colored. It is not large enough to cover the snail-shaped animal. The shell is 7 to 14mm. in length.

Pyramidúla asteríscus, Morse, the Star Snail, (Helix asteriscus), is a very small snail, being about one sixteenth of an inch in diameter. When examined with a microscope it shows a low spire and a large umbilicus, while its four whorls are marked by many minute, sharp cross-ridges; its color is brown. It is widely distributed, living in wet grass, from New England to California.

Pyramidúla (Helicodíscus) lineátus, Say, the Little Lined Snail, has a discoidal shell an eighth of an inch across, in which the four whorls are coiled up almost in the same plain, with raised lines revolving upon them. It is found all over the United States.

Oreohélix striatélla, Anthony, the Ribbed Snail. This is another small snail, having a shell

6 to 8mm. in diameter. It has four whorls, a large umbilicus, a circular aperture, and many low crossribs. Variety *cronkheitei,* Newc., is a little convex above, and the whorls are almost channeled; diameter 5mm. From Alaska and Oregon, also northern California.

Fig. 103

Oreohélix strigósa, Gld., the Mountain Snail, (Patula strigosa), is the most abundant snail found between the Rocky Mountains and the Sierra Nevada range. It assumes very many forms, one of which is well shown in Figure 103. It abounds especially in Idaho and Utah, and some varieties are found far up on mountain sides, even as high as 8,500 feet. The shell has a broad umbilicus, a nearly circular aperture, and a sharp lip. The whorls are about five in number, and in most specimens the spire is low. The average diameter is rather less than an inch, though some varieties are much smaller.

Perhaps no shell in the country has so many varieties as this mountain snail. Some are almost smooth, some ribbed spirally, others transversely. Some are nearly white, others marked with brown stripes. Very many of the varieties have received names, such as cooperi, hemphilli, gouldi, castanea, and multicostata, but it would be out of place in this small volume to attempt to describe them all. One of the most marked varieties, which we shall even consider as a distinct

species, is *Oreohélix idhoénsis*, Newc., the Idaho Snail, a view of which is shown in Figure 104. The shell is small, strong, and white. The whorls are crossed by many blunt ribs. Its diameter is about half an inch.

Fig. 104

Oreohélix élrodi, Pilsbry, Elrod's Snail, is another of this series, and is found in the Mission Mountains, Montana. The last whorl of this shell has an acute, peripheral keel, for which reason it is believed by Dr. R. E. C. Stearns to be identical with the California species, Epiphragmophora circumcarinata. Others doubt the identity, though the resemblance is very great. The shell is nearly an inch in diameter.

Oreohélix cockerélli, Pils., Cockerell's Snail, is found in New Mexico and Colorado. It has the general shape of P. striatella, but is far smoother. The shell is thin, greenish, streaked with light yellow; diameter about 6mm.

Pátula solitária, Say, the Solitary Snail, is essentially an eastern species, being particularly abundant near the Ohio River. Nevertheless it is found in Idaho, Oregon and Washington. The shell is low, conical, has five whorls, a large, circular umbilicus, and a sharp outer lip. It is of a yellowish brown color, and the whorls are marked with two dark brown bands with a lighter stripe between them. Its diameter is three-fourths of an inch or more.

Punctum conspéctum, Bland, the Dial Dot-shell. One morning a few years ago I was surprised to

find the sun-dial on the lawn all dotted with little groups of these microscopic snails. Soon afterwards they disappeared as suddenly as they had come, and I have never seen them since, though I presume they still live among the grass roots. Under the microscope the shell is very pretty, having a moderately elevated spire of four whorls, which are marked by fine cross ribs. The umbilicus is large, and the shell when inverted looks like a shallow bowl. The shell is dark horn-colored, and is about as large as the head of an ordinary pin. Var. *pasadénae,* Pilsbry, is widely umbilicated, and is without the spaced riblets, or has them very slightly indicated. Its diameter is 2mm. It was found in a garden in Pasadena, which fact indicates its good taste.

Púnctum randólphii, Dall, Randolph's Dot-shell, has a minute, reddish brown shell with dull silky luster. Its four whorls are quite elevated, and the umbilicus is small. It is very minute, having a diameter of less than 2mm. It is found near the city of Seattle, under leaves.

Hélix aspérsa, Müll., the Spotted Snail, is a European species which was introduced into this country many years ago. It seems to thrive about settlements, quite unlike most of our native species, and in some places it has already become a source of annoyance, eating garden flowers and vegetables altogether too freely. It is very easy to raise broods of the young of this species in a snailery, which may be constructed somewhat like a small hotbed, for they feed readily on lettuce and

cabbage leaves, reaching full size in about two years. I once reared a large number in this way, but at length was obliged to dispose of them for fear that they would escape and do injury. The shell is large, about an inch in diameter, nearly globular, thin, and marked with wrinkles. The color is brownish gray, with bands of chestnut and threads of yellow, giving the shell a spotted appearance, from which fact it takes its name. This species is used for food by the French, and it is not unlikely that some were brought to this country for the purpose of propagation.

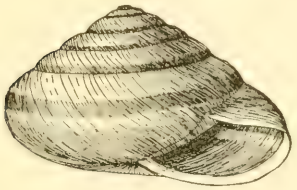


Fig. 105

We begin our study of our most interesting division of the old genus Helix, by examining the picture of a fine specimen of *Epiphragmóphora fidélis,* Gray, the Faithful Snail, as shown in Figure 105. The long name given to this division of snails means the "epiphragm-bearer," and the epiphragm is the door which the snail constructs across the entrance to his shell when he goes into retirement, as many of these creatures do during some part of the year. In the dry region it is during the summer, and in the colder parts of the coast it is during the time of frost and snow. This epiphragm is not a permanent affair like an operculum, but is constructed of dried mucous and resembles white blotting paper. Sometimes there are several layers, one behind another.

The fine species of which Figure 105 gives a good idea, lives mostly in the north, and is especially abundant in Oregon and Washington. The shells vary much in size and color, but the larger ones are an inch and a half in diameter. The color is generally dark beneath, but it is more or less banded and lighter above. Albino specimens have been found. The animal has a tinge of red in its complexion, and altogether I know of no more beautiful combination of form and color than is seen some misty morning in summer when this fine snail is found extended on a cushion of fresh green moss, beneath the protecting foliage of an old forest tree.

Epiphragmóphora infumáta, Gld., the Smoky Snail, is commonly reckoned as a variety of the last species, but it is so different that I prefer to consider it as distinct. It lives along the northern coast region of California. In size it is similar to E. fidelis, but the shell is much depressed and flattened, and the body-whorl has a sharp, angular edge, or keel. The shell has a peculiar cloth-like surface, and is of a nearly black color throughout. The umbilicus is distinct, and the aperture very oblique.

Fig. 106

Epiphragmóphora mormónum, Pfr., the Mormon (Island) Snail, is shown in Figure 106. The shell is large and depressed, the surface glossy, and the brown girdle is edged with white. There is a large umbil-

icus, and the lip is recurved. This species lives in the Sierra Nevada Mountains, and was first named from specimens taken on Mormon Island in the American River. It does not live in Utah, as one would at first suppose.

There are several varieties. Var. *cala,* Pils., is smaller and less depressed. It is dark reddish brown in color. The types are from the Calaveras Big Trees. Var. *búttoni,* Pils., resembles the last in color, but the shell is more depressed, and the surface is set with little prominences that bear golden brown hairs. Var. *hillebrándi,* Newc., is sometimes reckoned as a distinct species. The shell is yellowish horn color, with a chestnut band bordered by white. In fresh specimens the shell is hirsute. This variety also comes from the mountain region.

Epiphragmóphora circumcarináta, Stearns, the Keeled Snail. This species was described by Dr. Stearns as a variety of E. mormonum, but it seems too distinct to remain as such. The shell is widely umbilicated, flattened, angulated, with a peripheral keel. Beside this there are many cross-ribs, parallel with the lines of growth. A rare species from Tuolumne Co., Cal., possibly identical with Oreohelix elrodi, from Montana.

Cypress Point is a projection of land, a few miles south of Monterey, which looks out boldly upon the broad Pacific ocean. The huge waves come rolling in and beat themselves into spray against its rugged cliffs, and the sweet breath of

the ocean pours over the tree tops and then rushes on across the hills, carrying health and vigor to the parched interior of the State. There is no more delightful spot on this beautiful earth than this same Point of the Cypress Trees, and whoever visits it carries away a picture of mingled wildness, sublimity and beauty.

It is well named, for here, within the compass of a few score acres is the diminishing home of the cypress trees of California. From this little spot came the seeds which have developed into hundreds of miles of beautiful hedges, and tens of thousands of beautiful trees.

The parent-trees are venerable specimens, blown by the strong sea breezes into the most fantastic forms. Here is one on the very edge of the bluff; its trunk is horizontal, and its thick-leaved top slants up from the ground like the moss-covered roof of an ancient farm house. Here stands another, grim and solitary, with a gnarled and twisted trunk upholding a close-reefed sail of bright green foliage. And there is a little group of them, kneeling together towards the east, like penitent pilgrims, yet showing by their defiant limbs, which are bent and knotted like the arms of wrestling giants, that although the proud west wind has brought them to their knees, still their spirit is not broken, and that they continually throw back his challenge, and will never yield their ground till the last green leaf has withered on their scant and flattened tops.

In the midst of all this mingling of the beautiful

and the picturesque is the home of a very humble but very interesting mollusk, named *Epiphragmóphora dupetithouársi,* Desh., the Point Cypress Snail, shown in Figure 107. During the summer months I have sought them under the old cypresses, and have found them quietly sleeping under old logs, behind pieces of loose bark, among the twigs forming a wood-rat's nest, and in other out of the way places. Many empty shells also I found, to my great regret, for each had a hole in the side or near the apex, showing that the occupant's life had been violently taken. For this act of vandalism the blue-jays were evidently responsible, and even while I was collecting my few specimens, these saucy birds stormed and scolded in the trees, as if I, and not they, was the real robber. I verily fear that these reckless marauders will speedily rob Cypress Point of one of its chiefest attractions.

Fig. 107

However, I took away a number of dormant specimens of the snail, as well as a good number of the best shells which the jays had dared to desecrate, and after their long summer's sleep I placed some of the former in a fernery, and sprinkled them with water. After a few hours they slowly pushed themselves out into the open world and became quite lively for snails, and seemed to enjoy their state of captivity to a very reasonable degree. One of these captives posed for his pic-

ture, one fine day, and you see the result in the engraving.

The shell is umbilicated and seven-whorled; the spire is low conical, and the outer lip is but slightly thickened. The peristome is whitish, but the shell is dark chestnut, with a still darker band, which is edged with equal stripes of light yellow. The animal is slate-colored, and its surface is covered with numerous little elevations. The diameter of the shell is about three-fourths of an inch, though specimens are occasionally found that are somewhat larger.

Epiphragmóphora sequóicola, Cooper, the Redwood Snail. This species resembles the last in size and general form, but it has a more elevated spire. The surface of the shell is not smooth, but is somewhat roughened by cross lines, while the upper whorls have many crowded granulations. It is found in the vicinity of the coast, near Santa Cruz, Cal.

Epiphragmóphora tráskii, Newc., Trasks's Snail, comes from the coast regions of southern California. It has a small umbilicus, six whorls not greatly elevated, which are dark horn-colored, with a narrow chestnut band which is edged on both sides with white or yellow. The surface is marked with microscopic striæ. The diameter of the shell is usually less than an inch. There are several varieties, which will be mentioned in the List.

Epiphragmóphora carpentéri, Newc., Carpenter's Snail, comes from San Diego and Mexico. It

resembles the last species but has a more delicate shell. It is decidedly a southern form.

Epiphragmóphora coloradoénsis, Stearns, the Colorado Snail, was originally found near the Grand Canyon of the Colorado, opposite the Kaibab plateau, at an elevation of 3,500 feet. The views of the shell given in Figure 108 are magnified, but they give the form with great detail. The shell is rather fragile, and varies from pale horn-color to white, with a reddish brown band.

Fig. 108, x $\frac{2}{1}$ (*)

Epiphragmóphora exarátа, Pfr., the Furrowed Snail, is a species which resembles a small E. arrosa. The shell is yellowish, with a narrow band of chestnut, and the surface is decidedly plowed up with fine transverse furrows. There are seven whorls, ending in a white, slightly reflected lip. This species is from the coast region of California, both north and south of San Francisco. Its diameter is about an inch.

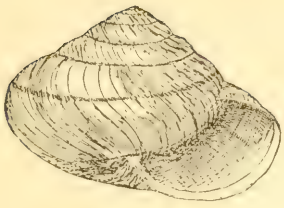


Fig. 109

Epiphragmóphora arrósa, Gld., the Dented Snail, shown in Figure 109, has a fine large and rather solid shell. The seven whorls, which are yellowish brown in color, are banded with a dark stripe, which is wider than is represented in the cut. The shell is quite rough, with furrows and hammer marks, and the umbilicus is distinct, though partly covered with the reflexed peristome. The home of this species is along the coast of central California, especially in Marin County.

Fig. 110

Epiphragmóphora californiénsis, Lea, the California Snail, Figure 110. The original specimens of this much disputed species came from Monterey, Cal., and that is where it now grows to perfection. It loves sand and sea air, and in summer it may be found near Point Pinos, buried in the sandy soil, underneath the abundant clumps of Rattleweed. The figure represents a large specimen. The shell is thin, delicate, and almost globular in form; it is of a light horn-color, with a dark band.

While this typical shell is almost spherical, a number of varieties exist, which diverge from the typical shape very materially. In fact, it has been a disputed point whether they are at all related, but as the general trend of modern research in-

clines in that direction they will be so classified in this book.

Var. *nickliniána,* Lea. Shell minutely umbilicated, rather thin, faintly indented and granulated; ash yellow with a chestnut band, lip white, reflexed at the base. Whorls six, spire moderately elevated. It lives near the coast of central California. Diameter one inch.

Var. *ramentósa,* Gld. The surface of the shell is cut up into innumerable checks, which are shown by a lens to consist of little oblong grains, arranged parallel to the lines of growth. The epidermis of the young ones is studded with little bristles. Diameter about three-fourths of an inch. This form is found in Alameda County, Cal., and in adjacent regions.

Var. *diabloénsis,* J. G. Cooper, has a flattened shell, umbilicated and thin, with regular malleations arranged in revolving series, like dents caused by the blows of a small hammer. Diameter rather less than an inch. From the Coast Mountains of central California, being named from its occurrence near Mt. Diablo.

Var. *contracóstae,* Pils., is smaller than the last variety, yellowish straw-colored, only slightly malleated, outer lip thickened. From Byron Hot Springs, Contra Costa Co., Cal.

Epiphragmóphora ayresiána, Newc., Ayer's Snail, is a species from the islands of Santa Rosa, San Miguel, and Santa Cruz. The shell is quite strong, six-whorled, and has a considerably elevated spire and a distinct umbilicus. Microscopic

striæ may be traced upon the shell. It is of a brown or chestnut color, and is usually girdled with a broad, dark band. Its diameter is three-fourths of an inch.

Epiphragmóphora tudiculáta, Binney, the Bruised Snail, has a shell large, rather thin, marked with numerous indentations; umbilicus nearly or completely closed, peristome white and thickened near the umbilicus. The six whorls are of an olive brown color and a rather wide band with a lighter space above and below it encircles the body-whorl. Diameter upwards of an inch. This is a southern species, being found about San Diego, also ranging northward through Tulare and adjacent counties to the Sierras. Var. *umbilicata,* Pils. Shell smoothish, malleation weak, umbilicus widely open, diameter 27mm.; from San Luis Obispo Co., Cal.

Epiphragmóphora gábbi, Newc., Gabb's Snail, comes from San Clemente Island. The shells are about the size of large peas, thin, light horn-colored, with a dark band. Var. *facta,* Newc., is more solid and compact. Whitish; peristome yellowish, thick, and reflected. From Santa Barbara and San Nicolas Islands.

Epiphragmóphora rufocíncta, Newc., the Red-banded Snail, is a small species from Catalina Island. The shell is smooth, thin, with a low spire. Horn-colored, with the ever present band of chestnut, which marks so many of the California snails. Diameter, 17mm.

Epiphragmóphora intercísa, W. G. B., the Horse-shoe Snail, has a shell strong, solid, with lines of growth distinct crossed by regular spiral lines cutting the surfaces into little blocks. The aperture is oblique and shaped like a horse-shoe. Color, white or brown, sometimes obscurely banded; diameter, 22mm.; from San Clemente and Santa Cruz Islands.

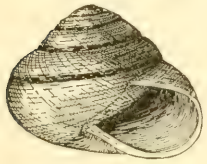


Fig. 111

Epiphragmóphora tryóni, Newc., Tryon's Snail, is shown in Figure 111. The shell is strong and solid, globose conical, with a rounded apex and five regular whorls. The surface is reticulated or cut into fine checks by the crossing of spiral threads and the lines of growth. The color varies from white to brown, and the whorls are often banded, while the upper half of each whorl is usually darker than the corresponding lower half. The animal is said to be black. Chiefly from Santa Barbara Island.

Epiphragmóphora kellettii, Fbs., Kellett's Snail. The shell consists of six whorls, spire rather low, umbilicus nearly closed. Shell smooth, color varying from whitish to brown, usually mottled, with a dark ring around the center of the body-whorl. Diameter about an inch. From Catalina Island, where it is reported as plentiful on and under the old cactus branches.

Epiphragmóphora stearnsiána, Gabb., Stearns's Snail, is sometimes called a variety of the last species. The shell is narrowly umbilicated, solid, with fine incremental striæ. Whitish, with ash-

colored spots and a brown band. Found on the seaweed side of Point Loma, San Diego, where most of the specimens are dead, and in Lower California.

Epiphragmóphora arnheimi, Dall, Arnheim's Snail. This small snail is found in Costra Costa Co., Cal., near San Pablo. Its diameter is 18mm. The suture is deep, also the umbilicus, while the lip is unusually thick for the size of the shell.

Fig. 112

Glyptóstoma newberryánum, W. G. Binney, Newberry's Snail, is a very distinct species, found in southern California, particularly around San Diego. A basal view of a small specimen is shown in Figure 112, for large ones grow to a diameter of an inch and a half. The spire is flattened, and the umbilicus is very large, distinctly showing the coil of rounded whorls. The lip of the aperture is thin and acute, the whorls are six in number, and the color of the shell is dark brown, sometimes almost black.

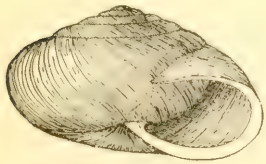


Fig. 113

Polygýra townsendiána, Lea, Townsend's Snail. This distinct species whose fine, large shell is shown in Figure 113, is a true northerner, being found mostly in Oregon, Washington, and even much farther to the north. The shell is strong, the spire but little elevated, the color yellowish or brownish, sometimes mottled. Peristome like a white horse-shoe, umbilicus large and

distinct. The surface is marked with many microscopic spiral lines, which are crossed by roughened ridges. Variety *ptychóphora,* A. D. Brown, is found in Idaho and eastern Oregon. The shell is nearly smooth and is of a light horn-color but it has the regular markings and the broad white peristome of the typical specimens; diameter, 20mm.

Fig. 114

Polygýra columbiána, Lea, the Columbia Snail, Fig. 114, (Mesodon columbianus), is a species which extends from Alaska southward into California. Whorls six, umbilicus small, peristome reflected, aperture ear-shaped. In some varieties, as shown in the cut, there is a small white tooth on the inner wall of the aperture. The figure is of the natural size. The shell is light horn-colored and the epidermis on the upper whorls is set with short, stiff, microscopic hairs. Var. *armígera,* Ancey, is smaller, more globose and convex beneath, and more beset with hairs, which are arranged in very oblique rows. Var. *labiósa,* Gld., has a very circular aperture, and widely reflected peristome.

Polygýra dévia, Gld., the Devious Snail, (Mesodon devius), is a species which lives in Oregon; it has also crossed the Cascade Mountains, and entered Idaho. The shell is horn-colored or brown, solid and six-whorled. The peristome is white, wide, and bent back at right angles to the wall of the aperture. There is a distinct white tooth on the inner wall of the aperture, and sometimes one or more waves on the peristome. There are several

varieties which range from half an inch to a whole one in diameter.

Polygýra mulláni, Bland, Mullan's Snail, was sometimes considered a small variety of the last species, but is now believed to be distinct. The shell is shining, with a thin epidermis covered with minute spiral lines, and tubercles. The aperture is three-lobed, and the umbilicus is partly covered by the lip. Shell dark horn-colored, diameter half an inch. There are several varieties which will be noticed in the List.

Polygýra loricáta, Gld., the Mailed Snail, (Triodopsis loricata), has a little shell only a quarter of an inch in diameter, but its five and a half whorls are very distinct. The umbilicus is small but deep, and the spire low dome-shaped. Aperture irregular, with white tooth on the columella and two thickened spots on the outer lip; surface horn-colored. Found in California near San Francisco, and also in the Sierras.

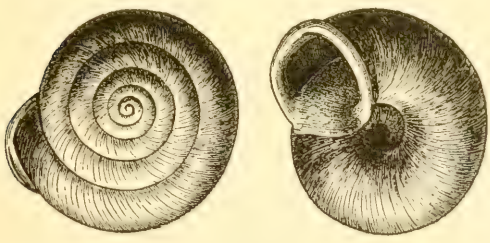


Fig. 115, x $\frac{2}{1}$ (*)

Polygýra chiricahuána, Dall, the Chiricahuana Snail, is shown in a much magnified form in Figure 115. The shell is depressed, thin, polished, and of a dark brownish color. The lip is strongly reflected and the aperture is destitute of

teeth; diameter 18mm.; from Arizona and New Mexico.

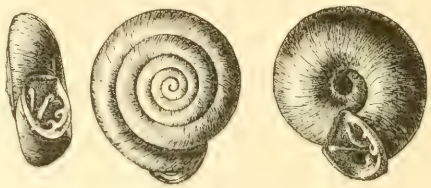


Fig. 116, x $\frac{3}{2}$ (*)

Polygyrameárnsii, Dall, Mearns's Snail, is shown in Figure 116. This shell is of a pinkish brown color. The details of the shell are well brought out in the three figures. Diameter, 13mm. Found in Arizona and in Hachita Grand Mountain, New Mexico.

Vallónia pulchélla, Müll., the Beautiful Vallonia, is a little mollusk whose shell consists of four rounded whorls arranged in a flattened spiral form. The umbilicus is large and open, the aperture nearly circular, the peristome white, reflected, and forming a nearly complete circle. The shell is whitish, thin, and in our variety is usually marked by cross-ribs. Its diameter is barely an eighth of an inch. The species is very widely distributed. A few years ago it suddenly appeared in Los Angeles, in the yard of Dr. Stearns. It is also reported from Oakland and many other localities in California, also from Utah and adjacent States.

Vallónia costáta, Müll, the Ribbed Vallonia, is another very small species, the shell being only 2.5mm. in diameter. Horn-colored, nearly flat, umbilicated, with regularly set membranous ribs, and fine striæ between them. It has about the same range as the last species.

Fig. 117, x $\frac{3}{2}$ (*)

Ashmunélla rhyssa, Dall, the Wrinkled Snail, is shown in Figure 117. The shell consists of six rounded, yellowish whorls, which are crossed by very numerous wrinkles. The reflected peristome is white, and immediately behind it the shell is considerably constricted. It was collected in the White Mountains of New Mexico by Rev. E. H. Ashmun. Diameter 17 millimeters.

Ashmunélla hyporhýssa. Ckll., the Less-Wrinkled Snail, occurs abundantly at Cloudcroft in James Canyon, Otero Co., New Mexico. This form lacks the parietal tooth.

Ashmunélla áshmuni, Dall, Ashmun's Snail. Three much enlarged views of the pretty little shell are given in Figure 118. The diameter is 14mm. The horn-colored whorls are crossed by very many fine, incised lines. From Bland, New Mexico, at an elevation of 8,000 feet above the level of the sea.

Fig. 118, x $\frac{2}{1}$ (*)

Ashmunélla pseudodónta,

Dall, the False-toothed Snail. Figure 119 gives us two enlarged views of this shell, which really is only 14mm. in diameter. It is of a yellowish straw-color with but little striation. From White Oaks, New Mexico.

Ashmunélla levéttei, Bland, Levette's Snail. This shell is umbilicated, thin, shining, translucent, obliquely striated, with seven whorls. Aperture with a transverse parietal tooth, with teeth on the lip also; peristome pale chestnut colored; diameter, 17mm. From near Santa Fe, N. M.

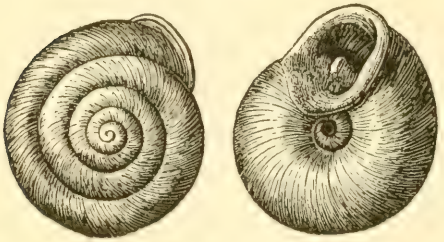


Fig. 119, x $\frac{2}{1}$ (*)

Sonorélla hachitána, Dall, the Hachita Snail, has a large, depressed, polished shell, with a deep umbilicus. It is pale reddish purple in color, with a purplish brown band. The diameter is about one inch. This species comes from Arizona and adjacent regions, being found on the top of Hachita Grande Mountain, N. M., at an elevation of over 8,000 feet.

Sonorélla rowélli, Newc., Rowell's Snail, is smaller than the last species. Its shell is whitish, with a single narrow, chestnut band. Aperture widely circular, peristome white, its extremities approaching and joined by a callus; diameter, 20 mm. It lives in Lower California, also in Arizona and New Mexico.

Cochlicópa lúbrica, Müll., The Brilliant, (Ferussacia subcylindrica), is shown in Figure 120. The little creature to which this shell belongs lives chiefly in forests, concealing itself under leaves, and the bark of dead trees. It is about the size and shape of a grain of wheat, thin, dark horn-colored, very bright and glistening. This species lives in Europe, where it is known in France as "la brillante," also in the Eastern States, Alaska, Oregon, Utah, and it has even been collected on Grizzly Peak, back of the University of California.

Fig. 120

The members of the genus Pupa are mostly very small, though some of them grow to a fairly good size. The shell shown in Figure 121 is a fair representative of this great genus. The picture is small enough, but even the cross beside it is too large for truth. The name is *Vértigo californica,* Rowell, the California Pupa. The shell is brown, and on the sides of the little aperture are four tiny white teeth. It lives in various parts of California on the main land, and two varieties live on Catalina Island.

Fig. 121

The Pupas belong to a very ancient family, as we know from the fact that a little fossil shell was found in a coal mine in Nova Scotia, and is reckoned as the oldest land shell ever discovered. They take their name, evidently from their resemblance to the cocoon of an insect, which in turn is supposed to resemble a doll. Many of these shells are exceedingly minute, measuring less than 2mm. in length. They are usually found in lowly positions, such as among grass-roots, under old

cacti, in river drift, and similar positions. The names of the chief species, with brief references, will be given in the List, but the shells are so very small that few of them will be fully described.

Holóspira arizonénsis, Stearns, the Arizona Pupa, is shown in Figure 122. The shell is really but half an inch long; the figure, however, brings out the details of its structure. In color it varies from dingy white to pale horn. It was collected at Dos Cabezas, Arizona.

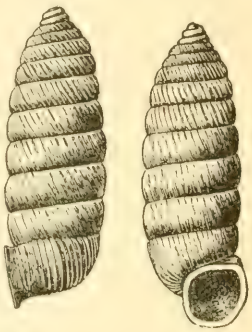


Fig. 122, x $\frac{3}{1}$ (*)

Some of the species of the old genus Pupa are now known as Bifidaria, among which we may notice *Bifidária armífera,* Say, the Armored Pupa. This species is found all through the East, also it has been collected in New Mexico. It is relatively quite large, being from 2 to 4mm. in length. It resembles Figure 121, but has six or seven whorls, and the aperture is almost filled up with projecting teeth.

Fig. 123

Figure 123 gives a view of the shell of *Succínea ovális,* var. *háydeni,* W. G. B., Hayden's Amber-snail. In general it may be said that the Amber-snails are rather small mollusks, which love moisture, though they do not often enter the water. The yellowish shell of this species is long, thin, and few-whorled. The aperture is very large, and from its base you can look inside

the shell to its very apex. The spire is small and consists of three delicate whorls. The length of the whole shell is three-fourths of an inch. The specimen from which the drawing was made was collected near Salt Lake, Utah.

Succínea avára, Say, the Greedy Amber-snail, Figure 124, has a smaller shell than the last species. The form of its delicate, horn-colored shell is shown in the figure, which is rather larger than the real shell. This species is reported from Idaho and southern California. Several varieties of this species live on the Santa Barbara Islands.

Fig. 124

Succínea rústica, Gld., the Rustic Amber-snail, is found in Oregon, California and Nevada. The shell is thin and fragile, of a pale greenish horn-color, surface rough and without luster, spire acute, length one-half an inch.

Succínea sillimáni, Bland, Silliman's Amber-snail. Shell oblong-ovate, thin, striate, shining; spire short, aperture large, oblique; length 20 mm.; found in California and Nevada.

Succínea oregonénsis, Lea, the Oregon Amber-snail. Shell one-fourth of an inch long, though sometimes longer, thin, yellow, rather coarsely striated, aperture two-thirds the length of the shell.

Onchidélla carpentéri, W. G. Binney, Carpenter's Onchidella. This is a little creature shaped like a short, fat Limax, the ends rounded, and the upper surface arched. The coriaceous mantle overhangs the locomotive disk. The body is smoke-colored; length, 5mm. It lives near the water, and is found from the Straits of Fuca to Mexico.

Onchidélla boreális, Dall, the Northern Onchidella, is but little larger than the last. Surface black, with dots and streaks of yellowish white, foot light colored, also muzzle and tentacles. Alaska, (Sitka), and Vancouver Island.

The Auriculidæ, or Ear-shells, inhabit salt marshes and love brackish water. They have strong shells with short spires, and narrow, ear-shaped apertures. The first of our species is named *Alèxia myosótis,* Drap., the Mouse-ear Alexia. The shell is brown and spindle-shaped, similar in form and size to a small grain of wheat. Probably it was imported from Europe, as it is found around Atlantic seaports, and also near San Francisco.

Carýchium exíguum, var. *occidentále,* Pils., the Western Carychium. Shell minute, distinctly conical, whitish, with an evident spire of fine rounded whorls. Aperture nearly circular, columella with a distinct tooth. From Portland, Oregon. The shell is about one-sixteenth of an inch in length; it is found about wharves and on stones which are sometimes covered with tide water.

Fig. 125

Figure 125 gives a good idea of the shell of *Melámpus olivàceus,* Cpr., the Olive Ear-shell. The shell is pear-shaped with a short spire and a long, narrow aperture. There are two folds on the columella. Dark brown, with lighter stripes and bands; length, half an inch; southern. It occurs plentifully on salt mud-flats.

Pédipes unisulcátus, J. G. Cooper, the Furrowed Pedipes. Spire short, body-whorl large

and full, columella marked with very large and peculiar white folds. Surface light brown, length one-fourth of an inch.

Siphonária peltóides, Cpr., the Shield-like Siphon-shell, has a limpet-shaped shell, small, thin, and low arched, with the apex a little to one side of the center. The color is light brown with more or less darker rays, and its length is one-fourth of an inch or more. The interior muscle-scar is divided on one side by a siphonal groove, but this mark is not always very distinct. This little mollusk lives on rocks between tides, and is quite rarely found. When disturbed it gives out a milky fluid.

Gadínia reticuláta, Sby., the Netted Gadinia. The natural size of the shell is shown in Figure 126. It is low-arched and has a nearly central apex, from which run radial lines to the edge of the shell. These rays are crossed by deep lines of growth, giving the shell a netted or reticulated appearance. Its color is pure white, and the shell is quite solid. I have found a few specimens living on mussel-bearing ledges, near low water line, but it is not often found alive. Dead shells are often washed up from the sea by the waves. Live specimens are said to be abundant at Pt. Lobos, Cal., in a tide grotto.

Fig. 126

Leaving the sea for a time we now turn our attention to the air-breathing mollusks that live in fresh water. Though in general they come to the surface to take a breath of air, yet they are very tolerant of restraint, and some seem to be able to live in the water continually. They are quiet,

vegetable eating mollusks, and clear away much matter in the water which would otherwise go to decay. Their shells are generally covered with a greenish brown epidermis, to protect them from the effects of acids which may be present in the fresh water. Sometimes the beaks are considerably eroded.

Fig. 127

Limnæa stagnális, Linn., the Pond Limnæa, Figure 127, is the largest of this class of fresh-water mollusks, and is universally distributed, both in this country and in the Old World. It is a very distinct species, and can be instantly recognized. Spire very slender, body-whorl and aperture very large; shell thin and delicate. It grows sometimes to a length of nearly two inches. This mollusk inhabits lakes and rivers, and is found on the Sierras, in Utah, and in many other localities.

Fig. 128

Limnæa palústris, Müll., the Marsh Limnæa, is shown in Figure 128. It is found all round the world, in the northern hemisphere. The whorls are rounded, five or six in number, and the aperture is shorter than the spire. The shell is horn-colored, and its form is well represented in the figure, which is larger than the average specimen. There are many varieties of this widely distributed species.

Limnæa adelínae, Tryon, Adeline's Limnæa, is a small species found at San Francisco. The shell is thin, the body-whorl large, and the inner lip thin and reflected. The outer lip is tinged with red within; length, 14mm. This shell is also reported from central Washington.

Limnæa pílsbryi, Hemphill, is a very small species with a shell only three-eighths of an inch in length, from Fish Spring, Nevada.

Rádix ámpla, var. *utahénsis,* Call, the Ample Radix. The shell is globose, irregularly ribbed, spire small, the last whorl inflated. Length, 17 mm., or considerably less. This rare form is found in Utah Lake, but a similar variety is reported from Sonoma Co., Cal.

Fig. 129

Figure 129 gives us a good view of the shell of *Limnophýsa caperáta,* Say, the Wrinkled Pond-shell. The spire consists of five rounded whorls, the aperture is oval, and the outer lip is slightly reflexed. This species ranges over a large part of North America.

Limnophýsa próxima, Lea, the Next Pond-shell, has a spire rather long and slender, with lip reflexed and body-whorl partly divided into small, flattened squares, like hammered silver. The shell is nearly an inch long. From Utah, also near San Francisco, and elsewhere in California.

Limnophýsa refléxa, Say, the Reflexed Pond-shell. The shell of this species is narrow and very much elongated. The spire is more than one and a half times the length of the aperture. It in-

cludes L. umbrosa, Say, and probably several other forms. This animal lives along the northern tier of States, from New York to the Pacific. It is also found in the Sacramento and Columbia Rivers.

Fig. 130, x $\frac{4}{3}$

Limnæa kirtlandiána, Lea, Kirtland's Limnæa, is shown in Figure 130. The shell is dextral and somewhat cylindrical, the spire long and five-whorled, the aperture rather small and oval, and the columella is marked with a fold. The cut is somewhat magnified, as the natural size is from one-half to three-fourths of an inch.

A common shell that is found in many of the brooks and streams over much of the Pacific Coast, as well as east of the Rocky Mountains, is shown in Figure 131. Its name is *Physa heteróstropha,* Say, the Reversed Physa. The shell is thin and delicate, of a light horn-color, with a small spire, a sinistral aperture, and is commonly about half an inch in length. The animal is black or nearly so, and when the shell is inhabited it appears much darker than when it is empty.

Fig. 131, x $\frac{3}{2}$

It is amusing as well as instructive to put some of these little creatures in a jar of water and watch their movements. Sometimes they will quietly remain at the bottom, eating the pulp of an alder leaf that you have given them; then they will rise to the surface to take a breath of fresh air and slowly sink back again, or perhaps they will crawl along, shell downward, apparently clinging with

their foot to the upper surface of the water—an apparently impossible feat, but they do it nevertheless.

They make little nests of transparent jelly, filled with minute eggs, and attach them to the side of the jar, where you can easily watch the development of the embryos. In my jar the little things came out after twenty days, each with a perfect shell, and began life on their own account. Such a jar may properly be kept in a schoolroom.

Physa polítissima, Tryon, the Polished Physa, is an inhabitant of Oregon. It resembles the last species in form, and has a brilliant shell, with a dark line near the edge of the outer lip. All of the Physas have sinistral shells, and may thereby be recognized at the first glance.

Physa carltónii, Lea, Carlton's Physa, comes from near Antioch, Cal. The body-whorl is full and round, horn-colored; outer lip marked internally with stripes of dark brown. It is quite large, having a length of three-fourths of an inch.

Physa gábbi, Tryon, Gabb's Physa, has a small spire, consisting of three or four minute whorls; body-whorl large, aperture large also, outer lip broad and full. Specimens from Portland, Ore., are light horn-colored, and from half to a whole inch in length.

Physa costáta, Newc., the Ribbed Physa, has a very small, thin shell, with a somewhat ribbed or corrugated surface. From Clear Lake, Cal.

Physa ampullácea, Gld., the Inflated Physa, has a large, full shell thin, shining and horn-colored.

It grows to the length of an inch, and lives in Oregon and Washington.

Physélla columbélla, Hempl., the Columbia (River) Physa, has a pretty little shell, half an inch long, consisting of a short spire, and a very round and full body-whorl, with an ample aperture. It is of a brown color, but the curved columella is often white. From the river the name of which it bears.

Fig. 132, x $\frac{3}{4}$

Apléxia hypnórum, Linn., the Moss Physa, (Bulinus hypnorum), is shown in Figure 132. Apex rounded, suture distinct and oblique, whorls six or seven, aperture moderate. Color, light brown, surface very smooth and glossy. This is a large northern species and it is also found in Utah. The variety *tryoni,* Currier, is collected in Montana.

Pomphólyx effúsa, Lea, the Puff Bubble, is a little creature that lives in the Sacramento river, also in the waters of Oregon, northern California and Nevada. The spire is exceedingly short, the aperture nearly circular and very large, the shell horny and sometimes ribbed; diameter a quarter of an inch. There are several varieties which have been described, that differ slightly in appearance.

Fig. 133 x $\frac{2}{1}$

A very distinct and characteristic fresh water shell is shown in Figure 133, which bears the name of *Carinifex newbérryi,* Lea, Newberry's Keel-shell. The whorls are few and are flattened at the top, while both above and below they are terminated by sharp,

angular keels. Umbilicus large, shell thin and horny, diameter one-fourth of an inch. From California lakes.

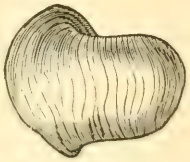
Fig. 134

Figure 134 gives us a good view of a mollusk that is very widely distributed, many of whose varieties have received special names. They are, however, considered as all belonging to the one species, which is named *Planórbis trivólvis,* Say, the Three-whorled Planorbis, (Helisoma trivolvis). In spite of its name the flat coil may consist of about four whorls. The color is light brown, and the aperture is irregular. The cut represents a rather large specimen.

Planórbis párvus, Say, the Little Planorbis, (Gyraulus parvus), has a very flat shell, consisting of a coil of fine, horn-like shell-tube. The whorls are about four in number, and the whole coil is from an eighth to a fifth of an inch in diameter. It occurs all through the East, also in the waters of the Pacific States.

Planórbis vermiculáris, Gld., the Worm-like Planorbis, (Gyraulus v). The tube of this little flat shell rapidly increases in diameter. Orbicular above, flattened beneath, same size as the last species; found in Washington, Oregon and California.

Planórbis ámmon, Gld., the Ram's-horn Planorbis, (Helisoma ammon), is a species found in the San Joaquin river and other bodies of fresh water in the central part of California. Figures 135 and 136 shows that the shell is large, robust, with a cup-shaped depression both above and below. As the animal grows it winds its shell round and round in the same plane, instead of making a spiral as in the case of most mollusks. Hence the shell is called Planorbis, or Flat-coil. The aperture of the shell is large and ear-shaped; the color is a rich yellowish brown, but is white within the aperture. The lines of growth are very distinct, and mark the shell in a pleasing manner.



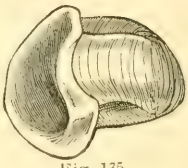


Fig. 135

Fig. 136

Planórbis bicarinátus, Say, the Two-keeled Planorbis, (Helisoma bicarinatus), resembles the last species, but is much smaller. The whorls have a sharp angle, or keel, both above and below the suture. Specimens were collected at Portland, Oregon.

Acrolúxus nuttállii, Hald., Nuttall's River-limpet. The shell of this little creature is shown in Figure 137. It is gen-

Fig. 137

erally circular in outline, brown, thin, and translucent, and is about a quarter of an inch in diameter.

Ancylus frágilis, Tryon, the Fragile River-limpet. Very small, thin, and narrow, limpet-shaped; color, light brown, one-fourth of an inch long. From Oregon and California.

Ancylus subrotúndus, Tryon, the Oval River-limpet. This little shell is similar to the last, but is more oval in outline. It comes from The Dalles, on the Columbia River.

Lanx patellóidea, Lea, the Spotted River-limpet. This is a species of fresh water limpet with an opaque, varigated shell. It is reported from Shasta County, Cal.

Lanx áltus, Tryon, the Tall River-limpet, is also reported from northern California. The shell is rounded, and elevated in the center. It is probably a variety of Ancylus newberryi, Lea, which has a very large shell for a River-limpet, sometimes reaching the length of 20 millimeters.

Gundláchia califórnica, Rowell, the California River-limpet, is very minute, limpet-shaped, with a small shelf across part of the aperture. It is found on the stems of plants growing in stagnant ponds.

With these little limpet-like shells we take leave, for the present, of the ponds and rivers, and turn once more to the sea, with all its wonderful wealth of animal life, which is inviting us to investigate the inhabitants of the great ocean home.

CHAPTER VIII

MARINE UNIVALVES

Fig. 138

Myurélla símplex, Cpr., the Simple Auger-shell, shown in Figure 138, is a southern mollusk, having a pretty, slender, conical shell. The spire winds gracefully upwards, and ends in a sharp point at the apex; while at the other end of the shell the aperture is small, and ends in a short, recurved canal. Following the sutures is a spiral thread of beads, which adds much to the attractiveness of the shell. The length is an inch or more, the whorls are about twelve in number, and the color is whitish or brown. This shell is our representative of a large number of tropical species of similar form, some of which are very strong, and as long as your hand.

Fig. 139, x $\frac{5}{4}$

Figure 139 also shows our representative of a large genus of shells, most of which are found in tropical seas. Its name is *Cónus califórnicus*, Hds., the California Cone. While large and beautiful specimens of the Cone-shells are found in the warm water of the Pacific and Indian oceans, our little species is very humble, being about an inch in length, while its surface is of a sombre chestnut color, though one may be found occasionally that has a brown, hairy epidermis. Specimens of this

shell are most common on the coast of southern California.

Figure 140 represents the shell of the rare and beautiful *Pleurótoma carpenteriána*, Gabb, Carpenter's Notched-side, (Surcula carpenteriana) This shell is spindle-shaped, with a conical spire, which slopes with the utmost grace to the apex, a long aperture, and an outer lip which has the characteristic notch near its junction with the whorl. The shell is marked with many fine lines of growth, each of which retains the peculiar notch. The color is reddish yellow, which is set off by numerous narrow, revolving stripes of reddish brown. The length of a good sized specimen is three inches. This species lives off the coast of California, and most of the specimens have been obtained by dredging.

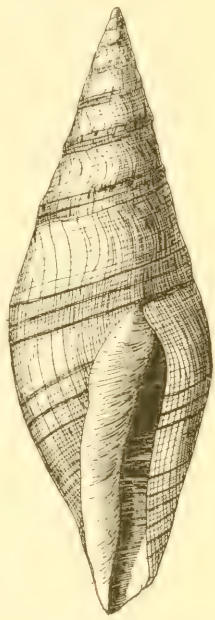


Fig. 140

Fig. 141, x $\frac{3}{2}$ (*)

Figure 141 gives us a magnified view of the shell of *Pleurótoma pervérsa,* Gabb, the Perverse Notch-side. It is called perverse, because the whorls revolve from left to

right, instead of in the usual way, and it is a "Notch-side" for a very obvious reason, which the picture so clearly shows. This species is dredged off southern California, and is also found in a fossil condition.

Pleurótoma tryoniána, Gabb, Tryon's Notch-side, resembles Figure 140, but the whorls are convex, angular, and ornamented by a row of nodes on the angle. It has been hauled up alive in the fishermen's nets at San Pedro.

Pleurótoma vinósa, Dall, the Tipsy Notch-side, is shown in Figure 142. This is a northern species, found around the Aleutian Islands and that vicinity. It was described by Dr. Dall in 1874.

Fig. 142, x $\frac{4}{3}$ (*)

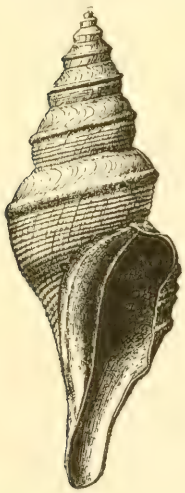


Fig. 143, x $\frac{5}{6}$ (*)

Figure 143 introduces us to another northern shell, 80 mm. in length. Its home is in Bering Sea, and its name is *Pleurótoma circináta,* Dall, the Girdled Notch-side. As shown in the figure each whorl is ornamented with a raised belt or girdle, from which fact it takes its name. The aperture is large, being half as long as the whole shell. Several other rare species of this genus will be mentioned in the List.

Figure 144 represents a very graceful shell named *Drillia penicillata*, Cpr., the Penciled Drill. The spire consists of eight slender whorls, the aperture is long, and the surface is smooth, brownish, and is marked by delicate cross-lines of color. It is found in the south. Tryon maintains that this species is only a variety of D. inermis, Hds.

Fig. 144

Drillia torosa, Cpr., the Knobbed Drill, Figure 145, is found rather farther to the north. It is somewhat less graceful than its southern relative, and is smaller also. The surface is almost black, but each whorl is marked by a spiral row of lighter colored knobs.

Fig. 145

The third species, *Drillia mœsta*, Cpr., the Doleful Drill, resembles the last, but the whorls have cross-ribs instead of knobs. It is a southern shell, and is found under stones between tides. Its color is brown or olive, and its length is one inch. A variety from San Pedro is smooth, with fine color lines.

Drillia empyrosia, Dall, the Burnt Drill, is shown somewhat enlarged in Figure 146. It has yellowish whorls, with a burnt sienna brown tint on the later ones, though a paler band shows white patches where it crosses the ribs. It is not found near the shore, but is dredged from deep water off San Pedro.

Fig. 146, x $\frac{4}{3}$(*)

Drillia incisa, Cpr., the Incised Drill, is an inhabitant of Puget Sound. Its shell is similar in shape to Figure 144, but is smaller, being but a little over an inch in length. Its surface is ash-colored, with reddish, revolving lines.

The genus Bela includes a large number of small shells, most of them from the north, and some of which are obtained by dredging. They are decidedly spindle-shaped, and many of them have the characteristic notch in the outer lip near the upper end of the aperture. The name of many species will be given in the List, but on account of their small size and rare occurrence they will not be farther described.

Figure 147 shows the shell of the pretty little species named *Mangilia mérita,* Gld., the Ribbed Mangilia. It has six whorls and the surface is marked by high cross-ridges and fine spiral lines. It is a white shell and is usually less than half an inch in length.

Fig. 147, x 3

Mangilia variegata, Cpr., the Variegated Mangilia, is similar to the last, but it has more raised ridges. The shell is thin, yellowish in color, especially around the aperture, though the spire is apt to be darker. Large specimens reach a length of 10mm. It is found on the coast of southern California.

In Figure 148 we have a bold picture of a rare and beautiful shell named *Cancellária coóperi,* Gabb, Cooper's Cancellaria. Fine, living specimens are occasionally hauled up in the nets of fishermen, or are gathered by the dredge, but good specimens are still very valuable. The few that have been found give us proof, however, that the depths of the sea hold many choice and beautiful treasures, and as we look over the blue waves we can in imagination call up fairy forms from their homes below.

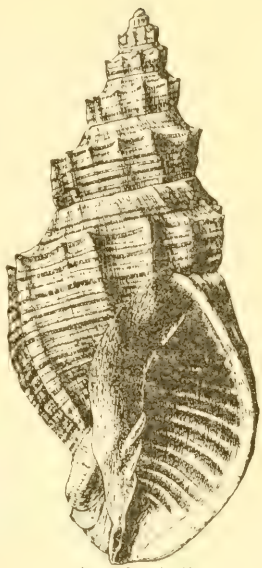


Fig. 148, x $\frac{7}{6}$ (*)

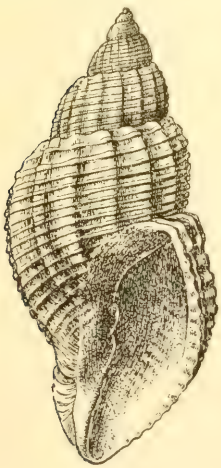


Fig. 149, x $\frac{5}{4}$ (*)

Cancellária crawfordiána, Dall, Crawford's Cancellaria, Figure 149, is another fine species which was dredged alive in Drake's Bay, by Mr. J. S. Arnheim of San Francisco. The surface of the shell is pale brown, while the throat is pure white. Its length is 43mm. It is to be hoped that many more specimens of this fine shell may be brought to the surface by careful dredging.

Another rare shell belonging to the same genus is shown in

Figure 150. Its name is *Cancellária middendorffiána,* Dall, Middendorff's Cancellaria. It comes from the far north, being found in Bering Sea and vicinity. Its white shell is only 17.5mm. in length, and is covered with a pale yellow epidermis.

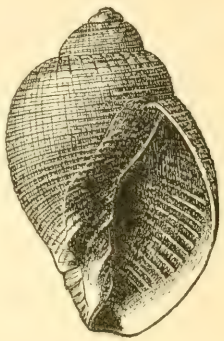


Fig. 150, x $\frac{2}{1}$ (*)

One fine summer morning I rose very early, took my long rubber boots, an old hoe, and a basket, put a few crackers in my pocket, and silently stole away from the little tent among the pines where the rest of my family were continuing their slumbers. I followed the long path which led along the cliffs, here coming down close to the shore, and there cutting off a sharp headland of rocks, till I reached my destination. This was a little strip of sandy beach from which the water had all receded, for it was at the very lowest ebb of the early tide. I sat down upon a rock, took a cracker from my pocket, and began to investigate both it and the prospect. In front of me was the strip of sand sloping down to the light waves; behind me was the high bank of earth, and the rocks were on either side; but no shell was to be found except a few well worn specimens which had been tossed up by some departing wave.

But I was not expecting to find shells in plain sight, so I cheerfully pulled off my shoes, and drew on those very convenient appendages, the

long rubber boots. Now I was ready for work, and taking up my hoe I began to dig in the sand. There was plenty of sand to dig in, in fact, too much of it, for it apparently took up all the room and left no place for the shells.

At length I struck upon a spot where a little stream of water was oozing out from the bank of sand. As I scraped away the surface, I saw something which would have made me dance for joy, had I not been weighted down by the long boots. For there in very truth was a live Olive, with its graceful shell shaped like Figure 151, and a beautiful, pearl-colored body, which it quickly withdrew into the shell and closed the aperture with a very insignificant scale, which seemed to be an apology for an operculum.

Fig. 151, x $\frac{1}{3}$

I picked up the little creature, and mused somewhat as follows: The name of this mollusk is *Olivélla biplicáta*, Sby., the Purple Olive-shell. It is about an inch long, and the shell, while apparently smooth and polished, is shown under the microscope to have very fine and beautiful reticulations. The spire is short, the aperture long and narrow, the canal a mere notch, and the outer lip is thin-edged. Upon the inner wall of the aperture is a lump of white enamel, and at the base of the columella are two little folds, which are referred to in the name biplicata, meaning twice folded. The color of the shell varies much in different specimens; some are almost pure white, others are very dark, but most of them are dove-

colored, with purple trimmings. They resemble the olives of our orchards in form and size, and their name has no mystery connected with it, but was doubtless chosen on account of their appearance.

As I proceeded with my hoeing my joy increased, for I found them by the hundred, and I had gathered about a thousand when the tide came in so far as to render further work impracticable. They seemed to lie in groups just under the surface of the sand, yet wholly concealed from sight. You must go at the very lowest morning tides, if you wish to gather them, and search till you find the bed; for they seem to be active burrowers and to travel rapidly from place to place.

I took some of them home and put them in a jar of beach-sand and sea-water. You will be pleased to do the same, if you ever have the opportunity, for their movements are very interesting. You will then see the plow-shaped foot which quickly digs a hole in the sand, and the long breathing-siphon which curls up through the canal and reaches through the sand up to the clear water, like the trunk of a swimming elephant reaching up for air.

To clean the shells it is simply necessary to spread them in the sunshine for a few hours, when the animal will be found to be dead and loosened from the shell. The soft parts can then be removed with a pin. To clean most shells, however, it is necessary to throw them into boiling water. In a few minutes they can be taken out and the ani-

mal withdrawn by a little hook or bent wire. Many marine mollusks may be killed readily by simply putting them into a dish of warm fresh water and leaving them for a little while.

If only a portion of the body can be obtained the shell may be put into a solution of formaldehyde or some other disinfectant for a time, and when dry the opening may be plugged with cotton, to which the operculum may be attached by a drop of glue. They will then appear as if they were living specimens. Much will depend upon one's time and taste for this part of the preparation, but the thorough cleaning of the shell is indispensable, and should be attended to as soon as possible after the specimens are gathered.

Fig. 152

Olivélla pedroána, Conr., the Pedro Olive-shell, (O. baetica) Figure 152, has a more slender shell than that of the last species. The lip is thin, the spire quite tapering, while the color is generally brown or bluish.

Olivélla intórta, Cpr., the Twisted Olive-shell, has a small, oval shell, more compact than that of the last species. The spire is elevated, and the suture is very distinct. There is a large callus on the upper part of the inner lip, and there is but one distinct fold on the columella, instead of two, as in O. biplicata. There are generally more or less yellow stripes on the surface of the shell, the greater portion of which is light colored. The outer lip is more curved at the base than that of the last species.

Fig. 153, x $\frac{2}{1}$

A pure white little shell is often found washed up on sandy beaches which is highly prized by the children, who often call it a Rice-shell. The true Rice-shell, which is a little white Olivella, pointed at both ends, does not exist on our coast, though it is found abundantly in the West Indies. Our white shell, shown in Figure 153, belongs to another genus. Its name is *Marginélla jewéttii*, Cpr., Jewett's Marginella, though it will do no harm to continue to call it a Rice-shell. The little cross beside the picture indicates the true length and breadth of a large specimen. There are several plaits, or folds, on the columella.

Marginélla vária, Sby., the Colored Marginella, (Volvarina varia), is a pretty little shell about the size and shape of a fat grain of wheat. It has a very short, rounded spire, a long aperture, and a plaited columella. Its surface is very smooth and glossy, and varies in color from white to brown, the shades being often laid on in bands and stripes. It is a southern species, and is often found on rocks between tides. Several other minute species of Marginella will be mentioned in the List.

Fig. 154 x $\frac{2}{3}$

Mítra maúra, Swains., the Dark Miter-shell, is shown in Figure 154. It is a dusky relative of the beautiful and brilliant Miter-shells which are taken in the vicinity of Australia. Our species is by no means gaudy, either in color or ornamentation, but has a plain, smooth

shell, which is almost black, and is wholly devoid of the gay trimmings of its relatives. The columella is ridged by three strong, oblique folds, which are very conspicuous. The cut represents a small specimen, for dead shells are not infrequently found that are fully two inches in length, though they are almost always somewhat broken. Fresh specimens have a black epidermis.

Mitromórpha áspera, Cpr., the Rough Miter-form, Figure 155, is really only five millimeters in length, but the enlarged picture gives the details finely. It has a brownish surface, and is marked with a very distinct sieve-like network of fine lines.

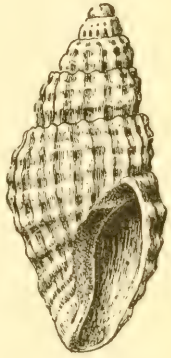


Fig. 155, x $\frac{9}{1}$ (*)

Fig. 156, x $\frac{6}{1}$ (*)

Mitromórpha filósa, Cpr., the Threaded Miter-form, is shown in Figure 156. The little shell is about a quarter of an inch in length, and is almost black in color. Very distinct spiral lines run around it, giving it a threaded appearance.

Fúsus kobélti, Dall, Kobelt's Spindle-shell, is beautifully shown in Figure 157. It is very graceful in form and occasionally grows to the size of the picture, though usually it is not over two inches in length. There are five or six whorls, with nine elevations on each whorl, crossed by fine, dark, spiral lines, though the main color of the shell is whitish.

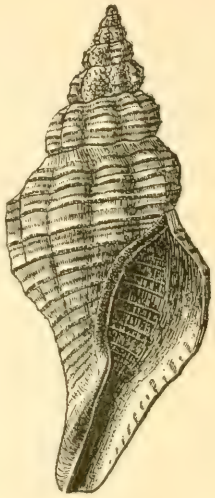


Fig. 157, x $\frac{4}{5}$ (*)

Fúsus luteopíctus, Dall, the Painted Spindle-shell, Figure 158. (Fusus ambustus), is really about 20mm. long. The spire is ornamented by numerous ridges, extending up and down, and there are spiral paintings to be seen, especially inside the outer lip, the colors being light yellow and dark brown.

Fig. 158, x $\frac{3}{4}$ (*)

Figure 159 shows us another shell, named *Fúsus harfórdi,* Stearns, Harford's Spindle-shell, sometimes called Chrysodomus harfordi. It is a rare shell, a few specimens having been found off central California. In young specimens there

is a polished, ruddy brown epidermis, but in older ones there is a suspicion of shagginess. The interior of the aperture is white. And now we will examine a few of the shells from far-off Alaska; that land of wonderful interest, its hills clothed in evergreen, its mountains tipped with snow, its glaciers and icebergs, its mines and boundless forests, its numberless islands, bays, and inlets. Whoever has sailed along the coast of Alaska never forgets its wonderful beauty. In those cold waters, where salmon jump and whales spout close to your steamer and where the busy world seems far away,—in those polar waters live many mollusks, some of which are classed under the family of the *Buccinidæ*.

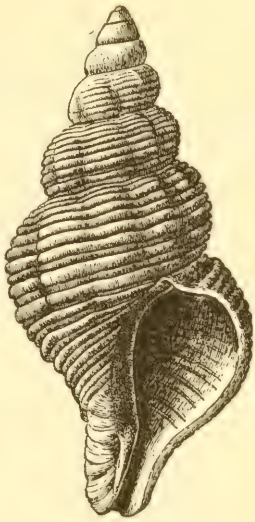


Fig. 159, x $\frac{6}{5}$ (*)

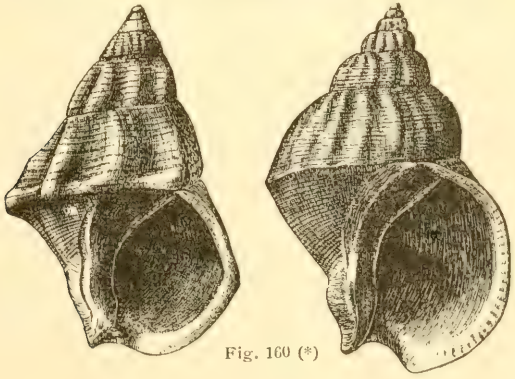


Fig. 160 (*)

Figure 160 represents two specimens of *Búccinum angúlatum,* Gray, the Angled Whelk. The pictures are none too large, for the shells are strong and robust. Both of them represent females, however, and the shells of the males of the same species are materially smaller. This species lives on the shores of the polar sea, near Bering Strait, and in the Arctic Ocean. It represents a decidedly frigid type.

Búccinum aleúticum, Dall, the Aleutian Whelk, Figure 161, has a thin, six-whorled shell, of a pinkish color with a white pillar. It is covered with a thin epidermis, somewhat bearded. The sculpture consists of fine, close-set grooves, with spaces between them. The figure is slightly magnified.

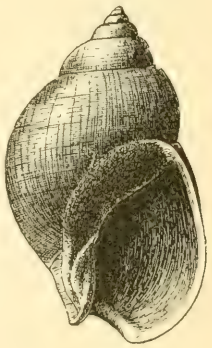


Fig. 161, x $\frac{4}{3}$ (*)

Búccinum percrássum, Dall, the Thick-shelled Whelk, is shown in Figure 162. This solid little shell is found in the waters that bathe the shores of Bering Island, a name that makes us think of sealskins and refrigerators. The operculum is remarkably distinct, and the shell is decidedly thick and solid.

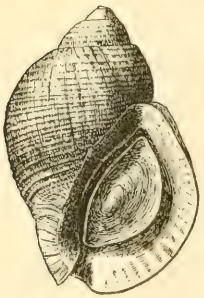


Fig. 162 (*)

Two specimens of *Búccinum castáneum,* Dall, the Chestnut

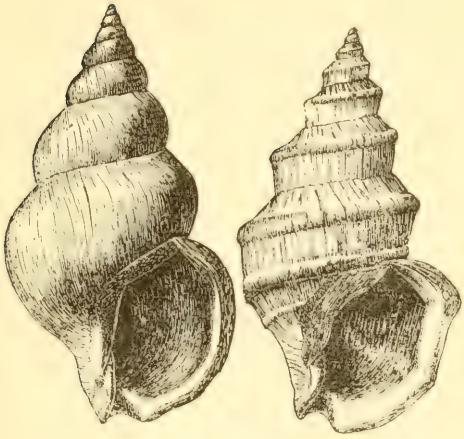


Fig. 163 (*)

Whelk, are shown in Figure 163. The left-hand figure represents the normal form of this large shell, while the other is a picture of the form with three ridges, which is known as var. *tricarinátum*, Dall. Both shells have a translucent, brown outer coat, and are marked with fine spiral lines of sculpture.

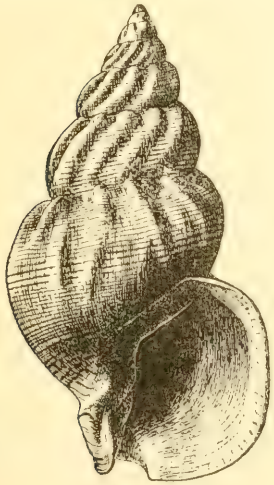


Fig. 164, x $\frac{3}{4}$ (*)

Búccinum pléctrum, Stimpson, the Lyre Whelk, is shown in Figure 164. The shell is distinguished by ridges, which suggest

the fanciful name, on account of their resemblance to the strings of a musical instrument. This species is also found on the shores of Bering Sea. It is not a common shell.

Búccinum víridum, Dall, the Green Whelk, shown in its natural size in Figure 165, is not a northerner, but was dredged from water half a mile deep, off the Santa Barbara Islands. The shell is delicate and thin, and is covered with a fine, greenish gray epidermis, which easily falls off. The outer lip is thin and but slightly reflected. The length is 46 millimeters.

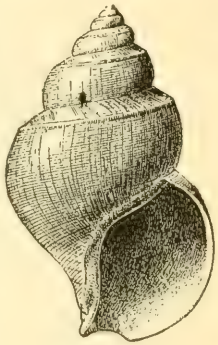


Fig. 165 (*)

We turn back now to certain Spindle-shells, the first of which is *Chrysódomus amiántus*, Dall, the Unspotted Spindle-shell, shown in Figure 166. It has a large, thin, white shell, with a prominent nucleus at the top, while it is marked with numerous narrow revolving ridges. This fine species was dredged near the Santa Barbara Islands.

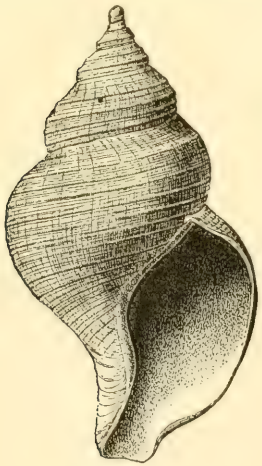


Fig. 166, x $\frac{5}{6}$ (*)

Chrysódomus dírus, Rve., the Dire Spindle-shell, Figure 94, was described and figured on a preceding page. It hardly seems to deserve

its ill-omened name, for there is nothing direful in its appearance, though its color is dark and mournful. It is also called Euthria dira.

Chrysódomus lirátus, Mart., the Ridged Spindle-shell, is a large Alaskan species, with a light brown shell some three inches long, swollen in the middle and pointed at both ends. The chief feature is the set of about ten strong ridges, or carinæ, which circle around the shell in a spiral manner, leading back from the outer lip to the very apex. I obtained a fine specimen on Wrangel Island.

Figure 167 gives a good idea of a somewhat similar shell known as *Chrysódomus tabulátus,* Baird, the Tabled Spindle-shell. It lives along the coast from Vancouver Island southward, inhabiting deeper and deeper water on the way. A beautiful specimen was recently dredged in Monterey Bay. The shell is of a yellowish white color, though sometimes darker, and can be readily identified by the tabulated whorls, with their flat tops.

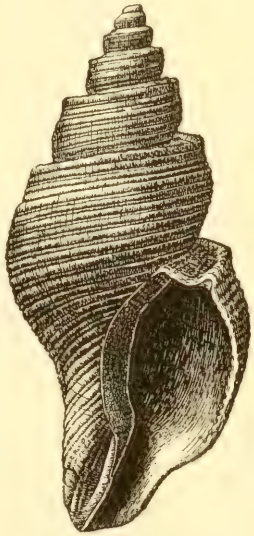


Fig. 167, x $\frac{3}{4}$ (*)

Chrysódomus kelléttii, Forbes, Kellett's Spindle-shell, (Siphonalia kellettii), is one of the largest of our mollusks. The

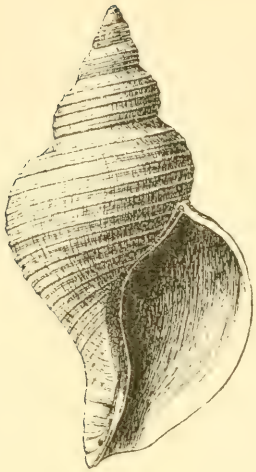


Fig. 168 (*)

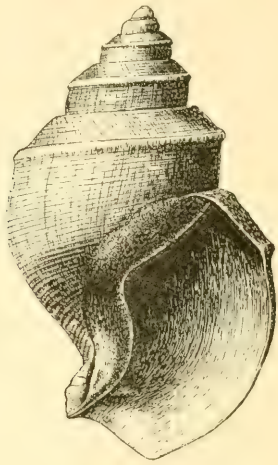


Fig. 169, x $\frac{5}{6}$ (*)

shell sometimes measures nearly 6 inches in length, and is strong and heavy. It has a regular, conical spire, three inches long, marked with numerous rounded knobs. The aperture is pear-shaped and the outer lip has many teeth and internal ridges, while the canal turns backward. The operculum is dark and conspicuous. This shell is chiefly found in southern waters.

Figure 168 gives a view of *Chrysódomus phoeníceus*, Dall, the Purple-red Spindle-shell. Its seven whorls are of a purplish brown color. The sculpture is feeble, and the epidermis conforms to the lines of growth. It was dredged off British Columbia in 238 fathoms of water.

Chrysódomus mágnus, Dall, the Great Spindle-shell, Figure 169, grows to a length of three inches. The shell is rather thin, the whorls flattened, with a strong keel at the shoulder, and there is a thick, bearded epidermis. This fine shell was dredged in Bering Sea.

Figure 170 represents a magnificent shell from the waters around the Aleutian Islands, and other regions in that vicinity. Its name is *Beríngius crebricostátus,* Dall, the Ribbed Bering-shell. It grows to a length of five inches. The color is white, with a darker flush in the throat, while the epidermis is bright yellowish.

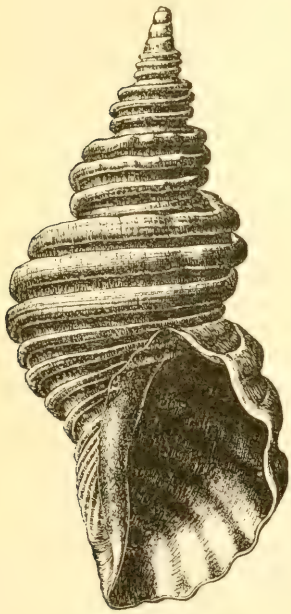


Fig. 170, x $\frac{2}{3}$ (*)

Beríngius friélei, Dall, Friele's Bering-shell, Figure 171, is another large shell of this species, which bears the name of the great navigator. Vitus Bering was a Dane by birth, but he entered the Rus-

sian service and made many discoveries in the northern waters. He was wrecked and died on Bering Island in 1741. Herr Friele, whose name also appears attached to certain shells, was a Norwegian. This shell is covered with a persistent, reddish-brown epidermis, and is delicately sculptured.

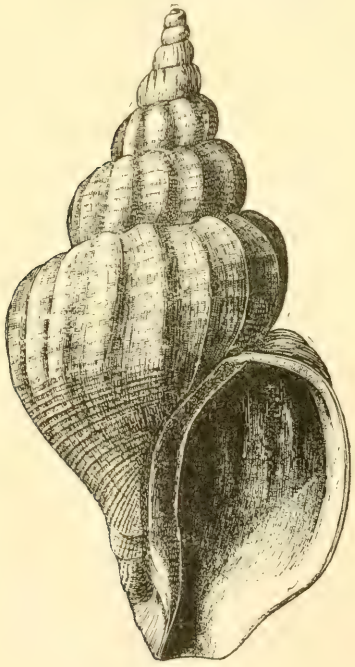


Fig. 172, x $\frac{2}{3}$ (*)

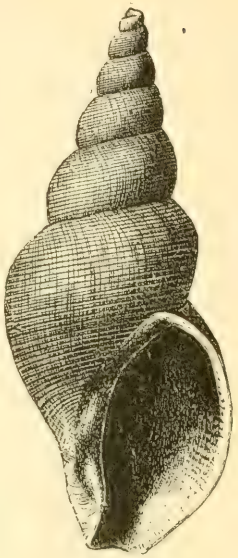


Fig. 171, x $\frac{1}{12}$ (*)

The aperture is snowy white within.

Another magnificent shell of this series is shown in Figure 172. Its name is *Beríngius kennicóttii*, Dall, Kennicott's Bering-shell. In spawning time it comes into shallow water on the coast of Kadiak Island,

but afterwards withdraws to greater depths. It has a light brown covering, under which the shell is whitish or purplish, though at the aperture it is somewhat pinkish. It is fully five inches in length.

Three large shells now follow, all of which were dredged by the U. S. Steamer "Albatross," in cold, Alaskan waters. The first is named *Strombélla frágilis*, Dall, the Fragile Strombella, Figure

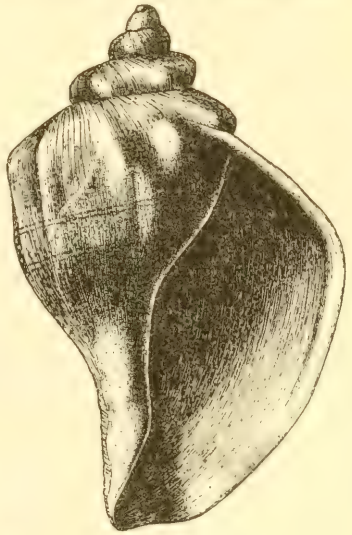


Fig. 173, x $\frac{2}{3}$ (*)

173. The shell is thin and inflated. Its color is pinkish, and there is a thin epidermis. The outer lip is widely deflected. 100mm. is about the length of this large shell.

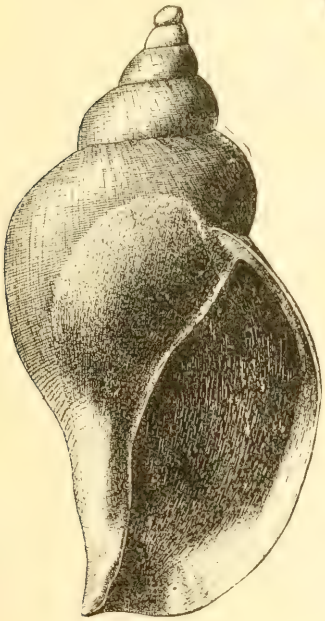


Fig. 174, x $\frac{3}{4}$ (*)

Strombélla mid-

dendórffii, Dall, Middendorff's Strombella, is shown in Figure 174. This fine large shell is marked by sharp, fine grooves which run around it spirally. The lip is reddish-yellow, or brown. It is a fine, shapely shell, and it reaches a length of 110 millimeters.

Figure 175 shows the largest shell of all, its length amounting to the remarkable extent of 137mm., while it is 75mm. in breadth. This splendid shell is named *Strombélla melónis,* Dall, the Melon Strombella. Although so large it is not very heavy, for it is very thin, like most of the true Melon-shells. Its shape is well shown in the picture. Its color is pinkish, or yellow and white.

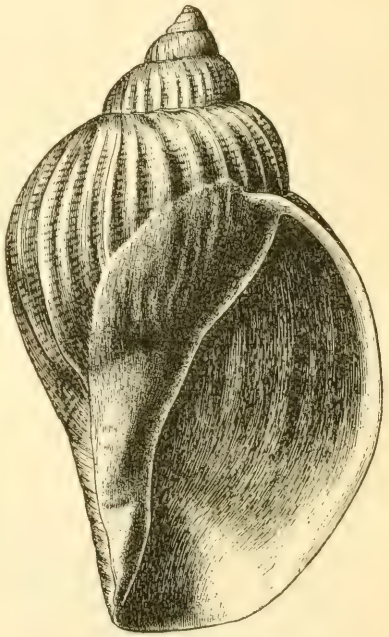


Fig. 175, x $\frac{3}{5}$(*)

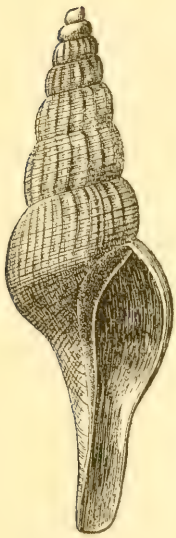


Fig. 176, x $\frac{2}{1}$ (*)

Tritonofúsus rectiróstris, Cpr., the Straight-beaked Spindle-shell, Figure 176. The picture is considerably magnified, but it represents the features of the shell very closely. The shell itself is white, but it has a polished, olive-brown epidermis. It lives in the waters of Puget Sound and vicinity.

Tritonofúsus herendeéni, Dall, the Nine-whorled Spindle-shell, Figure 177. This species is an inhabitant of more northern waters, having been obtained at various places in the far north, and it grows to a length of 70 mm. The shell has about nine whorls, and its color is pinkish white with a yellowish tinge beneath, and over all is a pale olive periostracum. There are several other species of this genus, which will be duly mentioned in the List.

Fig. 177, x $\frac{3}{5}$(*)

In Figure 178 we have a natural sized picture of the little *Mácron lívidus,* A. Ad., the Livid Macron. The shell is brown in color, and when found living it will be noticed that it is covered

Fig. 178

with a brown epidermis, which is laid on in little ridges, resembling a coating of fine, soft cloth. This species lives in the south, while another one, *Mácron Kellétii*, A. Ad., Kellett's Macron, is more commonly found on the coast of Lower California. It has a larger shell, which is of a darker color. The aperture is very large, the outer lip thin, and the canal a mere notch. Its length is rather more than an inch.

The large shell shown in Figure 179 comes from northern Alaska, and has received several names. It will be safe, however, to call it *Volutópsius kobélti*, Dall, Kobelt's Volutopsius. It is not a common shell, and the specimens that are collected are often beach-worn, but the picture represents a perfect specimen. Its full length is about four inches.

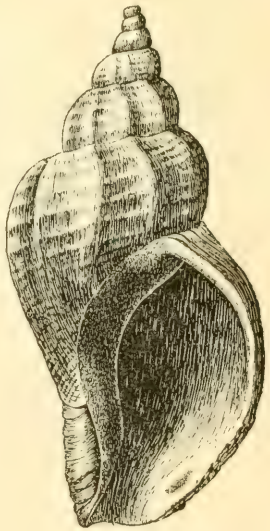


Fig. 179, x $\frac{3}{4}$ (*)

Volutópsius castáneus, Morch, the Chestnut Volutopsius, is found more abundantly than the last species. It lives in shallow water off the

Aleutian Islands. It is of a brownish color and has no epidermis. The aperture is large, the surface rough, and destitute of any spiral sculpturing. It is about the same size as the last species.

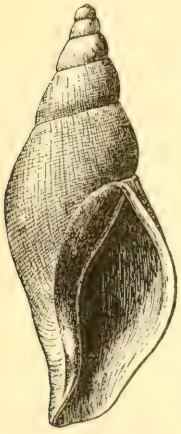


Fig. 180 (*)

Volutópsius attenuátus, Dall, the Slender Volutopsius, shown in Figure 180, comes from Bering Strait and the adjacent Arctic waters. The shell is thin, white, and delicately striated. The length is 58 millimeters.

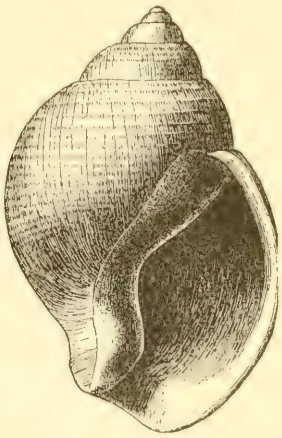


Fig. 181, x $\frac{2}{1}$ (*)

Liómesus nux, Dall, the Arctic Nut-shell, shown in Figure 181, is well named, for it much resembles a fat nut. It comes from the far north. The shell is dark colored with a creamy white layer above. In life there is a periostracum which resembles velvet. It is about the size of a walnut.

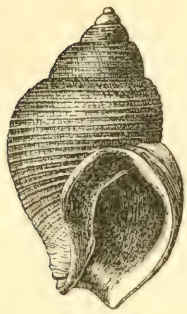


Fig. 182 (*)

Liómesus canaliculátus, Dall, the Channeled Liomesus, is shown in Figure 182. It is another northerner, and its shell is white, with a velvety epidermis. Its length is 35 millimeters.

The next genus which we will consider is named Nassa, a word which literally means a basket for taking fish. Most of the members of this genus have a reticulated surface, somewhat like network, or the sides of a basket.

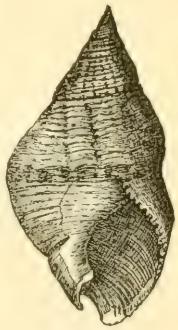


Fig. 183

Our largest member of the genus is shown in Figure 183, and is named *Nássa fossáta,* Gld., the Channeled Nassa. The spire is conical and ends in a pointed apex. The surface of the whole shell is marked with spiral and transverse ridges, the former of which appear also within the outer lip. The thickness of this lip varies much with the age of the animal, as does the callus of enamel which is spread over the columella. This enamel, in mature specimens, is of a bright orange color, and contrasts finely with the light ash-color of the general surface of the shell. The canal is short and abruptly reflected, while just above it is a deep ditch or *fossa,* showing at once from what fact the

name is derived. The use of the canal seems to be to afford space and protection for a breathing tube which projects above the surface of the mud which the animal is exploring for his prey.

The Nassas are active mollusks, and are cordially hated by the oystermen, because they are so fond of boring a hole through the shells of young oysters, and eating the contents with as much relish as any other judge of good living. They bore into various clams, too, and it is even hinted that they sometimes attack their own kind. But they are scavengers also, and consume the flesh of dead crabs and like animals, which are so liable to be found near the shore. In turn they are themselves eaten, for I have some beautiful specimens of this species which were taken from the stomach of a large fish,—showing that the biter of other animals is liable to be swallowed whole when the avenging and hungry fish comes around. The length of this shell is seldom as much as two inches.

Fig. 184

Nássa tégula, Rve., the Covered-lip Nassa, Figure 184, is a southern species, having a strong shell, a small aperture, and a reflexed canal. The inner lip is covered with a large callus of smooth, white enamel. The color is dark gray and the length is three-fourths of an inch.

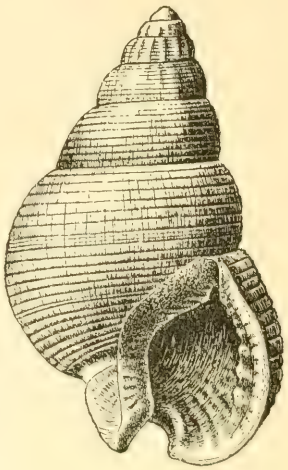


Fig. 185, × $\frac{3}{4}$ (*)

Figure 185 gives us an excellent, though greatly magnified picture of *Nássa inscúlpta,* Cpr., the Sculptured Nassa. This is a rare shell, being found in the south, and collected chiefly by dredging. It is thick and solid, the outer lip is strongly reflected, and there is no transverse sculpturing, except on the first few whorls. The color is light brown, but the aperture is white. My largest specimen measures 23mm. in length.

Fig. 186

Nássa perpínguis, Gld., the Fat Nassa, Figure 186, has the prettiest shell of any of our species of Nassa. The cut does scant justice to a good specimen, though it shows that the shell is finely checked, being cut into a multitude of little squares. The whorls are plump and fat, the shell rather thin, the color whitish or light brown, with sometimes a dash of orange inside, and a spiral stripe of chestnut running around the middle of each whorl.

Fig. 187

Nássa méndica, Gld., the Lean Nassa, Figure 187, is a variable species having a more slender shell than the last. The surface is marked with numerous fine, spiral lines, crossed by ridgy varices. Color, light brown, with a white peristome. It occurs all along the coast, from Puget Sound to San Diego. Var. *cooperi,* Fbs., has a few strong transverse ribs and small spiral lines.

Nássa californiána, Conr., the California Nassa, is a rare species, sometimes found alive on the coast of the southern half of California, particularly about San Pedro. It is as large as N. fossata, and has the sculpturing and general form of N. perpinguis. It is found fossil in various localities in the State.

CHAPTER IX

THE SMALLER SEA-SHELLS

When the tide is high, the waves often wash up great numbers of little shells into sheltered coves, and leave them there to be gathered when the tide has ebbed away. It is very pleasant to lie down upon the warm sand, on a summer afternoon, and while the waves are rushing to and fro at your feet, to look for these beautiful bits of organic structure. Whenever you find a pretty one you put it in a little bag, or what is more likely you lay it away in some large shell which you have picked up for that purpose.

Among the most abundant of the shells to be thus found on our coast is the little Frieze-covered Dove-shell, *Columbélla gausapáta,* Gould, (Astyris gausapata), shown in Figure 188. The shell is really about the size of a grain of wheat. The spire is conical, the lip thickened, and in the variety *carináta,* Hinds, there is a distinct keel on the upper part of the whorl. The coloring of the shell is chestnut brown and its surface is polished and

Fig. 188, x $\frac{2}{1}$

glistening, and often mottled with dots and stripes. This little mollusk lives in great numbers at the roots of the eel-grass, and dead shells are washed up abundantly upon the shore.

Fig. 189, x $\frac{3}{1}$ (*)

Columbélla (Astyris) aurantíaca, Dall, the Golden Dove-shell, Figure 189, was found many years ago at Monterey by Dr. Dall. It is a little shell, only 5mm. in length, and it varies in the color of its translucent shell from orange to brown. It sometimes has zigzag brown markings. It is found at low water.

Columbélla (Astyris) tuberósa, Cpr. the Tuberculated Dove-shell, is another species. The shell has a very slender spire and the body-whorl is angulated. The inside of the outer lip has a row of tubercules. The color is brown, and the length is about a quarter of an inch.

Columbélla chrysalloídea, Cpr., the Chrysalis Dove-shell. This is a southern species, having a somewhat cylindrical shell like the chrysalis of an insect. There are six whorls, very slightly convex, while the surface is marked by delicate spiral ridges and furrows. The spiral ornamentation is prominent on the lower part of the columella. Length, 8 millimeters.

Columbélla permodésta, Dall, the Modest Dove-shell, Figure 190, has a thin, polished shell of bluish white color, covered with a pale, yellowish epidermis. Its real length is 14mm. It was dredged from deep water off the Santa Barbara Islands.

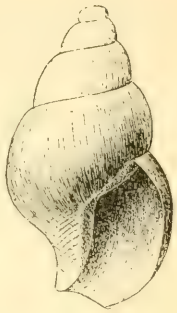


Fig. 190, x $\frac{3}{4}$(*)

Amphíssa versícolor, Dall, the Joseph-coat Amphissa, Figure 191, is a very common shell along the coast of California. The drawing gives a very correct idea of the appearance of the shell, though it is considerably enlarged, the common length being 8 or 10mm. The color varies exceedingly, as the name indicates. Some shells are reddish, others yellow, while still others are various shades of gray, and even almost black. A collection of these shells furnishes a very pretty assortment of tints. Living specimens are not so often found as dead shells, but at low water they may be discovered, clinging to the rocks.

Fig. 191, x $\frac{3}{2}$.

Amphíssa corrugáta, Rve., the Wrinkled Amphissa. The species lives chiefly in northern waters, and was formerly supposed to include the last species. Its shell is much larger, however, the average length being $\frac{3}{4}$ of an inch. It has a less ventricose body-whorl, and relatively finer sculpturing. It is usually of a light yellowish brown color.

Amphissa undáta, Cpr., the Wavy Amphissa, Figure 192. This species also has been confounded with A. versicolor, but it is really quite distinct, though of about the same size. The figure is much magnified, and the color pattern is ignored. It has been found plentifully in mud off Catalina Island in 16 fathoms of water.

Fig. 192, x $\frac{4}{1}$ (*)

Amphissa bícolor, Dall, the Two-tinted Amphissa, Figure 193. The shell is 14mm. in length, and is of a pale straw color, with a brownish base and a brown band. Specimens were dredged in various places off the coast of southern California, in quite deep water.

Fig 193, x $\frac{3}{1}$ (*)

We now come to the great family of the Muricidæ, in the shells of which the whorls are convex, and are crossed by three or more continuous varices. The aperture ends in a canal, which is generally partly closed. In warmer waters, like those of the tropical oceans, the members of the Murex family take on bright colors, and assume finer forms. With us they are more modest, though many of them are full of interest.

We begin our descriptions with a rare species *Múrex carpentéri,* Dall, Carpenter's Murex, Figure 194. The picture is of about the natural size, and clearly shows the main features of the shell. The aperture is small, oval, and has an elevated rim without denticulations. The color is reddish brown. There are three wing-like varices on each whorl, and between them the shell is nearly smooth. This species has been found at Monterey, and has been dredged in various places southward from the Farallone Islands.

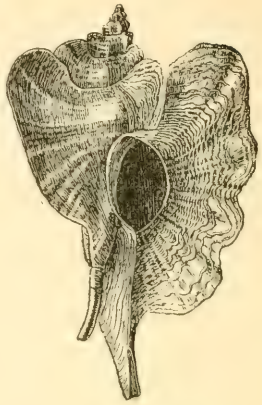


Fig. 194 (*)

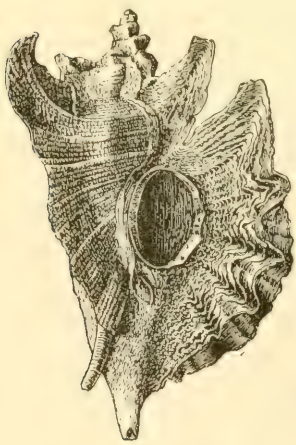


Fig. 195 (*)

The much befrizzled shell shown in Figure 195 is another of the three-winged California forms, and is named *Múrex pétri,* Dall, Peter's Murex. It was obtained by Mr. and Mrs. Oldroyd from rather deep water at San Pedro, so it doubtless takes its name from that of the locality where it was obtained. The color of the shell is purplish-brown, mottled with lighter spots. Its length is 65 millimeters.

Múrex trialátus, Sby., the Three-Winged Murex, is a much smaller shell, with dark brown and white color bands. The shoulder of the whorls is excavated, the three varices thick and rounded, and the frills sometimes beautifully recurved. A fine specimen was dredged by Mr. H. N. Lowe, off San Pedro, in 10 fathoms of water.

Múrex circumtéxtus, Stearns, the Circled Murex, Figure 196, (Ocinebra circumtexta), has a rather heavy shell, many low varices, very deep and distinct spiral grooves which give the outer lip a scalloped appearance. It is of a reddish color within, but externally it is whitish, with brown spots arranged in a spiral.

Fig. 196

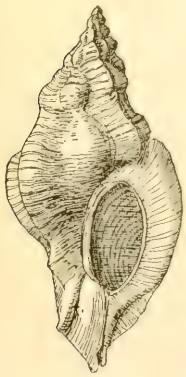


Fig. 197

Múrex festívus, Hds., the Festive Murex, (Pteronotus festivus), is shown in Figure 197. I have gathered fine specimens of this grand species at San Pedro, when the tide was low, by going among the piles of the wharves to which these and other species of mollusks were clinging. The shell is plainly marked by three reflexed frills on each whorl, alternating with rounded knobs. In perfect specimens there are numerous fine spiral lines of sculpturing, which are often covered with foreign substances. The canal is completely closed, forming a tube, which is reflexed near its extremity. The color is white

or gray, though the outside is often very dingy. The picture represents a good sized specimen, though it sometimes grows considerably larger. This species loves warm water too well to migrate far to the north.

Figure 198 introduces us to another southern shell, *Múrex nuttállii,* Conr., Nuttall's Murex, (Cerostoma nuttallii). If you examine a full grown shell of this species you will find a sharp tooth, or horn, near the base of the outer lip. Some young specimens have no horn, and they have an open canal instead of a closed one. Allowance must always be made for the age and development of the specimen. The shell of this species is about two inches long, and is of a dingy white color, somewhat marked with brown. On each whorl are three distinct varices, with rounded knobs between them.

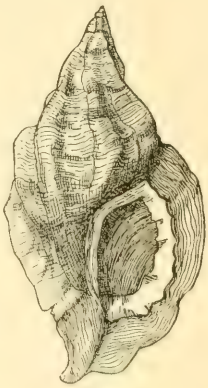


Fig. 198

Múrex foliátus, Gmel., the Leafy Murex, which is thought by some to be but a variety of the last species, has a larger shell which is very conspicuously marked by its three broad, wing-like varices, which appear to be made up of overlapping plates, like shingles on the roof of a house. A magnificent specimen, dredged near Monterey and given to me by Mr. J. K. Oliver of that city, measures 87mm. in length, and 63mm. in breadth.

Múrex incísus, Brod., the Incised Murex, (Muri-

cidea incisa,) belongs to southern waters, and is not common. The shell has strong, rounded, transverse ridges, which give the spire the appearance of being chopped full of holes. The color is white, with cross stripes of brown, and its length is an inch and a quarter.

Fig. 199

Figure 199 gives an excellent idea of a rare shell named *Tróphon triangulátus,* Cpr., the Three-cornered Trophon. The shell is quite large, but is of light weight, owing to the extreme thinness of the varices. It is reddish brown in color though nearly white internally. When examined closely it seems to be almost wholly made up of wings, and one wonders somewhat where the animal found internal space enough to carry on business. The original young specimen from which the species was named was dredged from the vicinity of Catalina Island, and was less than half an inch long. Adult specimens of the size of the cut have recently been dredged in considerable numbers in the vicinity of San Pedro, and a few have been found on the shore.

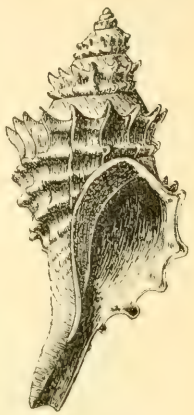


Fig. 200, x $\frac{3}{1}$ (3)

Boreotróphon scítulus, Dall, the Elegant Trophon, Figure 200, is a type of a large number of species which live mostly in northern waters, and which have been assigned to this genus. It is a little shell, only 17.5mm. in length but is supplied with an abundance of frills, as shown in the picture. It was first found in Bering Sea, but like many other of the cold water shells it probably exists in deep water as far south as the Santa Barbara Islands.

Boreotróphon stuárti, E. A. Smith, Stuart's Trophon, (Trophon orpheus). This fine shell has from seven to twelve varices, with the interspaces crossed by four or five rounded spiral cords. It sometimes reaches a length of two inches. The sharp, white varices make a crown at the suture. It ranges from Alaska to Santa Cruz, seeking deeper water as it comes southward, doubtless because the deep water is colder and more like its arctic home.

Boreotróphon grácilis, Perry, the Graceful Trophon, (T. multicostatus). This northern species has a pear-shaped shell, with several sharp, frill-like varices. The sutures are deep and the few whorls of the spire are very distinct. The color in small specimens is generally white, though often the interior is somewhat brown. It reaches

a length of an inch. Many other species of this genus will be found mentioned in the List.

Fig. 201

Ocinébra interfóssa, Cpr., the Sculptured Ocinebra, Figure 201, has a small, spindle-shaped shell, marked with spiral grooves, sharp varices, and deep sutures. It varies in color through shades of yellow, gray and brown.

Fig. 202

Figure 202 gives a good idea of the shell of *Ocinébra lúrida,* Midd, the Lurid Ocinebra. This pretty little shell is common at Monterey and other parts of the coast. It is spindle-shaped and is marked with fine spiral grooves. The aperture is oval, the canal sometimes open and sometimes tubiform. While the spiral lines are prominent the transverse sculpturing is faint. The color is reddish yellow, though sometimes nearly white. At low tide I have found living specimens, the size of the figure, clinging to stones.

Fig. 203, x $\frac{8}{1}$ (*)

Var. *múnda,* Cpr., shown in Figure 203, which is much enlarged, has low, rounded, transverse ribs, not varying from suture to suture, and regular, spiral lines. Its length is 16mm.; southern.

Ocinébra michaéli, Ford, Michael's Ocinebra, two good views of which are shown in Fig-

ures 204 and 205, occurs at Cayucos, San Luis Obispo Co., Cal. The color of the shell is light gray, with a narrow median brown band. The figures are much enlarged, as the shell is only 16mm. in length, and are reproduced by permission from the original engravings. The shell is named in honor of the Mr. G. W. Michael, who collected the first specimens.

Fig. 204 x $\frac{4}{1}$ (†)

Fig. 205 x $\frac{4}{1}$ (†)

Ocinébra poúlsoni, Nutt., Poulson's Ocinebra, has a strong, spindle-shaped shell, from one to two inches in length. Its surface is strongly marked with rounded varices, which are crossed by spiral ridges and fine, dark, spiral lines. The walls of the aperture in mature specimens are pure white, and within the outer lips are five or six little round knobs, or teeth. The canal is open and somewhat curved, and the operculum is a thin, brown scale.

(†) By permission from author of species.

The color of the shell is gray. This fine species lives in southern waters, and I have collected beautiful specimens at San Pedro.

Urosálpinx cinéreus, Say, the Oyster Drill, is an eastern species found in San Francisco Bay, especially around the oyster beds. It was probably introduced with young oysters from the Atlantic and has now become quite common. In size and appearance it considerably resembles Murex circumtexta, Figure 196, but the shell is thinner, and the spire longer and more pointed. As the name indicates, the shell is ash-colored, though it is reddish internally. Specimens may easily be captured at low tide, and often the little egg-vases may be observed, attached to stones or posts.

Trophon belcheri, Hds., Belcher's Trophon (Chorus belcheri). The large mollusk whose shell is so well shown in Figure 206 is found chiefly on the coast of southern California. It is one of our largest shells, the picture being much smaller than the real shell, and specimens have been found which were fully six inches in length. The color is dull white, somewhat tinged with brown. Specimens may

Fig. 206, x $\frac{2}{3}$

sometimes be picked up on the mudflats, at the time of low tide. The shell as a whole is pear-shaped, and ends in a long canal, to the left of which is a deep, funnel-shaped umbilicus. The spire is beautifully crowned with circles of sharp horns, and about the middle of the outer lip there is a large, pointed tooth.

We now come to the Purples, which received this name not because they are of a purple color themselves, but because in olden times a purple dye was prepared from the bodies of similar mollusks. This was especially true of a small Murex, *M. trúnculus*, that lives in the Mediterranean Sea, and the inhabitants of ancient Tyre were peculiarly skilful in preparing the rich "Tyrian dye."

Most of our Purples prefer to live where they will get frequent changes, for they select as a home those rocks that are alternately left bare and then covered again by the tide. They are carniverous creatures, and like the Oyster Drill they can bore through the thin shells of bivalve mollusks, and devour the poor inhabitants. We have but a few species on this coast, but some of them furnish very numerous specimens. The first and most common kind is named *Púrpura saxícola*, Val., the Rock Purple, Figure 207. Though the cut is larger than the average, still specimens are sometimes found that are fully as large. The shells differ much in details, even in specimens living near each other and it

Fig. 207, x $\frac{3}{2}$

is no wonder that many different names have been given to the varieties. In general the spire is short, the columella flattened, the outer lip thin, and the interior of the shell of a chestnut color. Sometimes the outside is smooth and almost black, sometimes the shell is light colored and coronated, but often it is of a dingy white, decorated with double spiral bands of dark brown, accompanied with spiral grooves. The Atlantic Purple, *P. lapíllus,* exhibits similar variations.

Fig. 208

Púrpura líma, Mart., the Grooved Purple, Figure 208, is more rarely met with than the last species, probably on account of its living in deeper water. The shell is commonly rather larger than that of the last species, while in appearance it is much more smooth and symmetrical. The spire consists of four whorls, separated by distinct sutures. The distinguishing feature, however, and the one which gives the name to the shell is the presence of about fifteen spiral grooves on the whorls, giving its surface somewhat of the appearance of a coarse file. The operculum, as in all the Purples, is thin, horny, and somewhat oval in shape. This is a very distinct species, and may be easily recognized by its rounded and channeled whorls. In the northern waters it is somewhat more similar to the last species, but a little care will usually easily separate them.

Fig 209, x $\frac{2}{3}$

Another Purple, which lives in San Francisco Bay, but is more highly developed a few hundred miles to the northward, is named *Púrpura crispáta,* Chem., the Wrinkled Purple, and a rather poor figure of a small specimen is shown in Figure 209. Specimens from Puget Sound are beautifully frilled and richly painted with brown bands. The shells are strong and heavy, and have an average length of an inch and a half to two inches. Some are nearly smooth, while others are extremely wrinkled. Though the smooth, white varieties are very plain in their appearance, some of the northern beauties, all frilled and banded as if to attract attention, are worthy of a place in any choice collection of handsome shells.

Closely related to the Purples are the Unicorn-shells, a small group of mollusks which are almost exclusively confined to the west coast of America. Their name refers to the fact that a little horn is developed on the edge of the outer lip, near the canal, as is well shown in Figure 210, *Monóceros engonátum,* Conr., the Angled Unicorn. These mollusks are found clinging to rocks, under a heavy growth of seaweed. The shells themselves are almost the same color as the stones to which they are attached. The name of this species is suggested from the fact that the whorls are

Fig. 210

sharply angled, quite in contrast with those of the next species.

Fig. 211

Monóceros lapillóides, Conr., the Pebbly Unicorn, Figure 211, has a pretty little shell, about an inch in length, with a spire of four whorls, a rather small aperture within which are several knobs, or teeth. It is well named for it distinctly resembles a rolled pebble of granite, and the word "lapilloides" means "like a little stone."

Monóceros lugúbre, Sby., the Sad Unicorn, is found in the extreme southern limit of our territory, though its home is on the west coast of Mexico. It has a thick, heavy shell, about an inch long. The wall of the aperture is of a brown color, and is marked with several rows of white tubercles. The little horn near the canal is very distinct.

It is now our pleasant task to consider a few species of pure white shells, regularly marked with frequent varices. All of them are quite rare, but if you search along the shore you will probably have the good fortune to find one or more of them.

The first one is shown in Figure 212, and is named *Scála boreális,* Gld., (Opalia borealis), the Northern Opal-shell. It consists almost wholly of a long spire composed of about eight whorls, each of which is crossed by eight blunt ridges, or varices. The aperture is entire, and the rounded lips are sometimes stained by the rich

Fig. 212

purple juices of the animal. The operculum is a brown scale, nearly circular, and showing lines of growth. The color of the shell is white, and its common length is about an inch.

Fig. 213

In Figure 213 is shown the beautiful shell of *Scála hindsii,* Cpr., the White Ladder-shell, (Scalaria hindsii). It is pure white, very delicate, and is generally less than an inch in length. The whorls are very distinct, finely rounded, and each one is crossed by about twelve thin, sharp ridges. These shells are so highly prized that they are sometimes worn as the drops of ear-rings. This species is found in the south.

Scála indianórum, Cpr., the Indians' Ladder-shell, is a species found more commonly in the north, especially about Puget Sound. It has a thicker shell than the last species, more whorls, more varices, and less prominent sutures.

Scála bellastriáta, Cpr., the Striped Ladder-shell is easily identified from the fact that between the varices fine spiral ridges may be seen, winding up towards the apex. The spire is short, the last whorl quite large, the varices very numerous, and the sutures so deep that they almost entirely separate the round whorls. Length, 15mm.; southern.

Scála crebricostáta, Cpr., the Close-ribbed Ladder-shell. This shell has about fifteen sharp, thin, reflexed varices to a whorl, which form a kind of crown at the shoulder. It is found from Monterey to San Diego.

Jánthina exígua, Lam., the Violet Snail, (Ianthina trifida). Out on the wide ocean lives the species with the above name. It is kept at the surface by a singular raft which it secretes, and it feeds upon small jelly-fishes. The shell is small and shaped much like that of a land snail. It is thin and delicate, and has a deep notch in the outer lip. The color is deep violet, quite unlike that of any other shell. Though it usually lives far out at sea, some shells get washed to the shore; but they are comparatively rare on our coast.

Eulíma mícans, Cpr., the Shining Eulima, comes next on our list. The shell has a beautifully polished, slender shell, with a very sharp apex and an elongated aperture. Large specimens grow to the size indicated by the cross in Figure 214. The color is nearly white, though the shell is somewhat dark near the apex. It could scarcely be mistaken for any other species. It is found from British Columbia to San Diego.

Fig. 214

Eulíma rútila, Cpr., the Red Eulima, resembles the last species but is very small and slender. Its color is rosy and the base of the shell is lengthened.

There are several other species the shells of which are small, being only a quarter of an inch or less in length. One of these is known by several synonyms: *Eulíma distórta*, *E. incúrva*, and *E. falcáta*. Its shell is curved, as all the names indicate. It has a variety with the singular name *E. yod*.

Fig. 215

Pyramidélla cónica, var. *variegáta,* Cpr., the Obelisk-shell, (Obeliscus variegatus). This little shell is shown in Figure 215. There is a fold on the columella, and it is brownish in color, though somewhat clouded. It is found in southern waters, but is quite rare, even there.

Having studied small shells for some time we turn now to a large one, shown in Figure 216, named *Scaphélla steárnsii,* Dall, Stearns's Volute. This great shell, which is nearly six inches long, comes from northern Alaska. The inner layer is purplish, while the outer, which resembles porcelain, is bluish white. Note the distinct whorls on the columella.

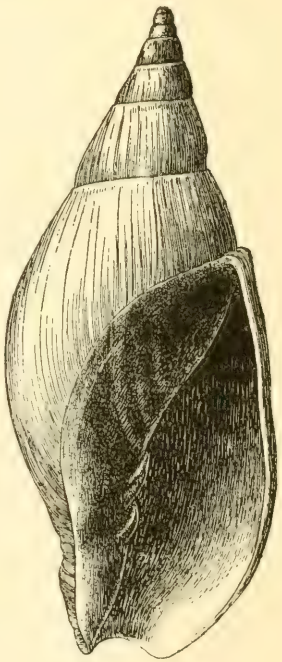


Fig. 216, x $\frac{2}{3}$ (*)

Scaphélla a r n h é i m i, Rivers, Arnheim's Volute, dredged in Monterey Bay a number of years ago, resembles the last species, but is only half the size. The color is yellowish, and the folds on the columella are four in number. It is to be hoped that more specimens of this fine species may yet be dredged from beautiful Monterey Bey.

From these two large shells we bound back to some very small ones most of which, in fact are so minute, that no attempt will be made to describe them in this book. Fortunately it is not necessary, for a work is shortly to be published by the National Museum, we are told, which will fully describe the great group of minute shells known under the generic name of *Turbonilla.*

The general shape of these little shells is shown in Figure 217, and the species indicated by that cut is known as *Turbonilla castánea,* Cpr., the Chestnut Turbonilla, (Chemnitzia castanea). Its eight or ten whorls are marked with numerous fine axial ribs, and though it is so small it is a beautiful shell. Its color is chestnut brown, as might be expected from its name.

Fig. 217

The Odostomias have white shells, less slender than those of the last genus. On the columella is a fold like a tooth as their name indicates. There are a good many species, most of which are very small. One of the largest shells is shown in Figure 218. It is known as *Odostómia pupifórmis,* Cpr., the Pupa-shaped Odostomia, (O. satura). This shell is beautifully white, not very thick, with deep sutures and a microscopic network of extremely fine lines. It is about a quarter of an inch in length. This species ranges along the whole coast.

Fig. 218

Odostómia nucifórmis, Cpr., the Nut-shaped

Odostomia, has a similar range, but it sometimes grows a little larger than the last species. It is rather stout and inflated and has a large body-whorl. The shell is white and solid, and the columella has a strong fold. Other species will be mentioned in the List.

Of a shy little Indian girl, in the village of Metakahtla, Alaska, I bought the s h a g g y shell, a drawing of which is shown in Figure 219. Its name is *P r i é n e oregonénsis,* Redf., and it is otherwise known as *Triton* or *Tritónium oregonénse,* the Oregon Triton. It is found in the northern waters, and is a very unique species, easily recognized by its fusiform shape, numerous varices, and its hairy, brownish epidermis. The inside of the shell is pure white.

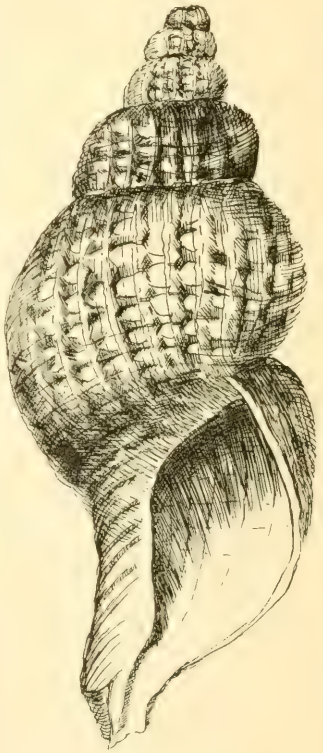


Fig. 219

Ranélla califórnica, Hds., the California Frog-shell, also known

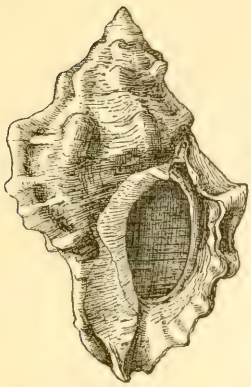


Fig. 220, x ½

as *Gyrínium califórnicum,* is represented in Figure 220. This fine shell is more common in the south, though some excellent specimens have been collected in Monterey Bay. The shell is very strong and solid, and on its surface are many knobs and ridges. It appears to grow forward about half a whorl and then pause and build up a thick lip. Leaving this ridge it goes on and completes the whorl, and then forms another varix. The result of this singular method of shell-building is that the shell has two ridges extending from the apex to the canal, on opposite sides of the whorl, giving the front of the shell a somewhat flattened appearance. The external color is yellowish brown, but within it is white. The common length of one of these shells is three inches, though some of them grow to twice that length, and thus rank among our largest shells.

Fig. 221, x ⅔

On Feb. 1, 1864, Dr. Newcomb described a little shell, which up to that time had been found in but very small numbers. The name which he then applied was *Pediculária califórnica,* Newc., the California Pedicularia. An enlarged representation is shown in Figure 221, from which you will see that the aperture and the outer lip are greatly extended and that the spire is completely hidden. The inside of the shell is smooth and

glossy, but the outside is slightly rough. With the aid of a microscope one may see a fine system of minute lines and meshes. Its color is peculiar, being a rich, rosy pink, very beautiful. These little shells are found on the stems of sea-fans, which are brought up from tolerably deep water. To these they cling like a parasitic insect; hence their name, which really means "louse-shell." When fully grown the shell may be nearly half an inch long, though most specimens are much smaller.

Fig. 222

Another fine shell found on our coast is the one shown in Figure 222, named *Cypræa spadicea,* Gray, the Nut-brown Cowry, (Luponia spadicea). It is our chief representative of the great genus which is so abundantly developed in the warmer oceans. Cowries have smooth, well-rounded shells and are great favorites with the children, who delight to use them for playthings. When young, the shells are thin and conical, with a short spire and a large aperture. As time goes on the outer lip increases in size and thickness, while the spire becomes completely hidden under the advancing whorls. In color, the lips of this shell are white, while on the back there is a ring of dark brown, with a central part of a lighter shade of the same color. I have in my collection an aged specimen that is over two inches in length, but such a size is the exception. This species is found in the south, but never in great numbers. When taken

alive it is one of our most beautiful shells. Dead specimens, which have been knocked about and defaced are far less bright and glossy.

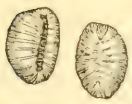


Fig. 223

The little Coffee-bean shell, *Trívia califórnica,* Gray, two views of which are shown in Figure 223, is eagerly sought by many children, who search in the sands for pretty treasures. Like the real coffee-bean, one side is flat, while the other is rounded and plump. The surface is marked by a dozen sharp ribs, and the long, narrow aperture is set with many small teeth. The general color of the shell is a reddish chocolate, though the interior is white.

Trívia solándri, Gray, Solander's Trivia, is a Mexican species, but it reaches as far northward as Santa Barbara. It resembles the last shell, but is twice as large, and is marked by a deep, longitudinal canal on the back of the shell.

Fig. 224

Somewhat like a very long and narrow Cowry is our next species, named *Ovula defléxa,* Sby., var. *barbarénse,* Dall, the Pink Egg-shell, (Ovulum formicarium), Figure 224. In appearance it is unique, looking more like a roll of shell than a spiral whorl, and tapering almost equally towards either end. The aperture is very long, the outer lip thickened, the spire concealed, and the sculpturing microscopic. The color is pink, and the length rather less than an inch. It is found sparingly at Monterey, Santa Barbara and elsewhere.

Fig. 225

We have two other species somewhat resembling the Cowries. The first is named *Eráto vitellína,* Hds., the Veally Erato, Figure 225. The shell is pear-shaped, or rather, balloon-shaped, and is quite smooth. It is of a dark reddish-brown color, though the toothed margin of the aperture is white. The ordinary length of the shell is about half an inch. Specimens are not numerous.

Fig. 226

Eráto columbélla, Mke., the Dove Erato, Figure 226, is very small and delicate, but well worth searching for. As shown in the figure, it has a visible, but short spire, and a long aperture with toothed lips. These are white, but the back is olive-brown. Dead shells may be rather frequently found, but living specimens have been dredged from considerable depths.

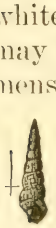


Fig. 227

Cerithiópsis tuberculáta, Mont., the Tubercled Horn-shell, Figure 227, has a small shell, about the length of the cross shown in the figure. The spire consists of six or seven whorls, well sculptured, and of a dark brown color, and the sutures are conspicuous. There are several other small specimens of this genus, all of which will be mentioned in the List.

Bittium filósum, Gld., the threaded Bittium, Figure 228. This fine little mollusk may often be found at low tide, by turning over stones and searching carefully for little shells. Tiny hermit-crabs are liable to

Fig. 228

appropriate them, and they may appear to be running off without any apparent means of propulsion. The shell is shaped like a short, stout thorn, and varies in length from one-fourth to one-half of an inch. The whitish or brownish whorls are eight or ten in number, and are marked by slight, spiral grooves.

Bittium quadrifilátum, Cpr., the Four-lined Bittium, is a southern species, with a smaller shell than the last. In shape it is a regular but very slender cone, and the whorls are marked by four equal spiral threads, which coil over slight cross-ribs.

Scila assimilis, C. B. Ad., the threaded Scila, (Cerithiopsis assimilata), has a slender shell, 10 mm. long, consisting of ten whorls around which run three spiral ridges, winding from the apex to the aperture. It lives from Monterey southward.

CHAPTER X

SHELLS WITHOUT CANALS

Fig. 229

My first opportunity to gather any of the shells described in this book occurred in 1877. The place was a shallow arm of San Francisco Bay, and the shell was the one shown in Figure 229. I shall never forget the pleasure I felt as I saw them lying by dozens and hundreds on the surface of the mud, after the tide had gone down. They seemed to be enjoying the fresh air, and displayed no anxiety for the return of the tide. Similar species in other countries spend so much of their time in the air, that they have been mistaken for land shells.

The name of this species proved to be *Cerithídea califórnica,* Hald., the California Horn-shell (*C. sacrata*). But at first I was as ignorant of the proper care of the shells as I was of their name, and a pretty source of trouble they were to me, for I had not then learned how to clean them properly, a process which has already been explained on a previous page.

The shell in question is an inch or more in length, and consists of about ten strongly ribbed whorls. The outside is dull and black, but the inside is of a glossy brown. The aperture is entire,

that is, it has no canal, and it is closed by a thin brown, circular operculum.

Trichótropis boreális, Br. & Sby., the Northern Hairy-shell. This species has a short spire, strongly shouldered whorls, which are hairy on the ridges, and a distinct umbilicus. There are many varieties, and the average length is about one inch. This species inhabits the Arctic waters on both sides of the continent.

Trichótropis cancellàta, Hds., the Checked Hairy-shell, has a longer spire than the last, consisting of about seven whorls. The epidermis, which is somewhat hairy, is light brown or grayish, and the aperture is often pink. It ranges from Alaska southward to Vancouver Island, where it is said to occur abundantly.

Anaplócamus boreális, Dall, the Northern Anaplocamus, Figure 230. This singular shell, which much resembles some that live in fresh water, comes from considerable depths off the coast of Alaska. It is bluish white, but has an olive-brown epidermis.

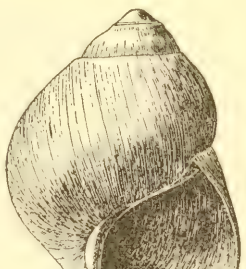


Fig. 230, x $\frac{4}{1}$ (*)

Cæcum califórnicum, Dall, the California Tube-shell. This singular species differs much from any that have gone before. The shell is a little white tube, 3mm. long, slightly curved, and show-

ing under the microscope that it is made up of many small rings.

Cæcum crebricinctum, Cpr., the Close-ringed Tube-shell, resembles the last species, but is nearly twice as large and is marked with exceedingly fine rings, sometimes quite indistinct. Both of these species are found in the south.

Vermétus lituélla, Morch, the Crooked Worm-shell, (Spiroglyphus lituella). This singular mollusk has an irregular, tubular shell, which becomes attached to the side of a stone, and twists itself into an ill-shaped, flattened cone. Several specimens are frequently found near one another. The shell is often angular and roughened; the aperture is circular, and is one-eighth of an inch or less in diameter. The color, as in several of the following specimens, is a dingy white.

Vermétus squamígerus, Cpr., the Scaly Worm-shell, (Serpulorbis squamigerus). Very irregular; frequently many specimens grow together upon a rock, and look like a heap of contorted snakes. The shell is marked throughout its length by transverse, scaly ridges. The aperture is circular, one-fourth of an inch across. The tube, if straightened, would measure some four inches or more in length; it has a circular operculum. I once found a few living specimens at Monterey, but it is rare so far north. Many of these more uncommon species may be found by wading into the water at low tide and turning up stones or bringing them out to dry land for closer examination.

Fig. 231

Turritélla coóperi, Cooper's Tower-shell, Figure 231. This southern species has a very slender, many-whorled spire. The sutures are distinct, the aperture circular, and the outer lip sharp and thin. The color is yellowish, somewhat spotted with brown. It can hardly be mistaken for any other shell. It is found on sandy beaches between tides.

Tachyrynchus (Mesália) tenuiscúlptus, Cpr., the Little Tower-shell, is like a minute specimen of the last, and is found on mud-flats along the southern coast. The usual length is less than one-fourth of an inch.

When you went to the seacoast, and climbed among the rocks where the waves were throwing up their spray as the tide was coming in, you surely saw numbers of dark-colored shells about the size of peas. You found them in the cracks of the rocks, along their sides, and concealed in every little nook and cranny. Their shells are dull in color, somewhat like the rocks themselves, the apertures are closed with horny opercula, and the animals seem to be asleep. But put some of them into a jar of sea-water, and soon the little black snails come creeping out, and begin to work their way up into the air again.

These little Littorines, as we will call them, are the first mollusks we meet as we go down to the shore. The upper part of the beach is known as the littoral region, so you see how the mollusks get the name of Littorine. They live out of the water

most of the time, and except at high tide they can always be found upon the rocks along the shore. Each of the little shells has a small spire of a few whorls, an entire aperture, a sharp outer lip, and a thin, horny operculum.

Fig. 232, x $\frac{3}{2}$

Our first species, *Littorína scutuláta*, Gld., the Checkered Littorine, is shown, slightly enlarged, in Figure 232. The shell is usually of a greenish gray color, with more or less white bands or checks. Within the aperture the shell has a decided purple tint. Its length is from one-fourth to one-half an inch, and you may sometimes find old specimens nearly as large as the picture.

Fig. 233, x $\frac{4}{3}$

Littorína planáxis, Nutt., the Gray Littorine, is shown in Figure 233. This species has a somewhat larger shell than the last and is easily distinguished by the flattened columella, which seems to be dissolved away by the animal in advance of the growing whorl. The shells of this species are more rounded, and less finely colored than those of the last, but the two are often found closely associated. Young specimens sometimes have shells banded with white, but there need be no hesitation in determining the species, for the flattened columella is the sure mark of identity.

The third Littorine, which is found in northern waters, is named *Littorína rúdis*, Don., the Rough Littorine. The shell of this bold northerner, in form and size, greatly resembles a large pea. It is easily distinguished from the last species by its rounded columella, while its general surface,

instead of being nearly smooth, as in the last two species, is marked by a good number of more or less developed spiral ridges. Its color varies from white to black, but it is usually of a yellowish brown.

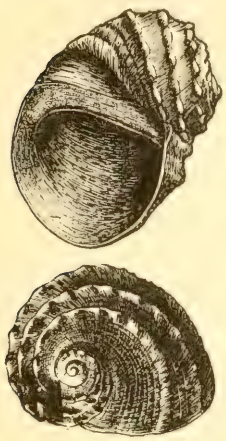


Fig. 234, x $\frac{5}{2}$ (*)

Littorína aleútica, Dall, the Aleutian Littorine, Figure 234, is found in the far north, as its name indicates. The broad pillar of the shell is white, the aperture dark, while the outside of the shell is yellowish brown. The diameter is about twelve millimeters.

Another shell from the same locality is shown in Figure 235. It is named *Littorína atkána,* Dall, the Atka Littorine. It is a large shell, 20mm. high, and its surface is nearly smooth. Most specimens are chestnut brown throughout, but some have bands, as shown in the figure. The pillar, or columella, is broad and white.

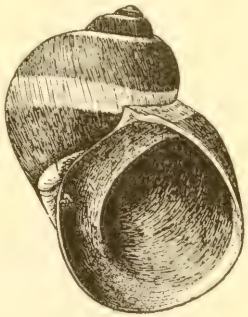


Fig. 235, x $\frac{2}{1}$ (*)

Fig. 236

Closely allied with the Littorines are the little Chink-shells, the very minute picture of one of them being shown in Figure 236. Its name is *Lacúna unifasciáta,* Cpr., the

One-banded Chink-shell. It is a very little thing, about one-sixth of an inch in length, and consists of but few whorls. It is brown and glossy, with the color broken into dots on the keel of the body-whorl. The aperture is semi-lunar, and the flattened columella has a small umbilical fissure, from which circumstance it receives its name. It is worth looking for, and can often be found on sandy beaches.

Lacúna porrécta, Cpr., the Wide Chink-shell, resembles the last figure, but is broader and more compact. The umbilical chink is large and the outer lip extended. It is found on kelp.

Lacúna solídula, Lov., the Solid Chink-shell. This species is chiefly found in the north. It is large, having a shell nearly half an inch long. There are three or four whorls, smooth and strong. The umbilicus is small, and the color brown, with white columella.

Lacúna variegáta, Cpr., the Striped Chink-shell. This species is tall, effuse, and has a wide chink. In color it is clouded or has zig-zag stripes. It lives on the coast of British Columbia, and may be found on the Zostera, or Eel-grass.

Fóssarus (Isápis) obtúsus, the Obtuse Isapis, has a roundish little shell, a quarter of an inch long or less. The aperture is oval, and the outer lip is diversified by shallow, spiral grooves. The spire is small and few-whorled, and the color is light brown.

Fóssarus (Isápis) fenestrátus, Cpr., the Windowed Isapis, resembles the last species, but is

marked with sharp, spiral ridges, about twelve of which may be seen on the body-whorl. The outer lip is thin, and the umbilical chink is small. Its length is 8mm., and it is 7mm. in breadth.

A series of river-shells now claim our attention. In general they are black, horn-shaped, and rather thin. Their inhabitants are dark-skinned, happy creatures, that love to live in cool, clear water, where the green algæ grow and the banks are edged with ferns and water weeds. I gathered them in abundance from a little stream of most delicious water that bursts out from the base of a dry hill, just north of the village of Sisson, in northern California. Evidently there are concealed passages leading from the dry hill up to the great snow fields on the flanks of Mount Shasta, for after you have climbed far up beyond the timber line and are walking over the great expanses of white you can hear the gurgling of little streams under your feet, and you know that the melting drifts are sinking down into the bosom of the mountain to reappear among the groves and meadows that mark the boundaries of the upper Sacramento.

Goniobasis plicifera, Lea, the Plaited River-shell, Figure 237, is a fine example of the shells of this group. It is easily distinguished from the other species of the River-shells by the folds, or plications, on the whorls, especially upon the upper ones. It is essentially a northern form, living in the streams of Oregon and adjacent territory.

Fig. 237

Gonióbasis occáta, Hds., the Harrowed River-shell, is found in central California. Its whorls are marked by many sharp, roughened, spiral ridges or keels.

Fig. 238, x $\frac{2}{3}$ (*)

Gonióbasis acutifilósa, Stearns, the Sharp-lined River-shell, Figure 238, has the last whorl marked with a few spiral keels. It was discovered in Eagle Lake, Cal., in 1877. The figure is rather more than twice magnified, but it shows the features of the shell admirably.

Gonióbasis rubiginósa, Lea, the Rusty River-shell, is an Oregon species. The earlier whorls have spiral keels, but the last one is rounded and has no sculpture.

Gonióbasis nigrína, Lea, the Black River-shell, Figure 239, has rounded whorls without sculpture. Its home is in northern California, where it inhabits the streams which unite to form the Sacramento River. There are several varieties, including var. *draytónii,* Lea, and var. *circumlineáta,* Tryon. Some authorities unite all of these smooth, rounded forms under the one species, *G. bulbósa,* the Bulbous River-shell, Gould, which has its home in the tributaries of the Columbia River.

Fig. 239

In this place properly belongs the description of quite a number of minute shells belonging largely to the family of the Rissoidæ, or Risso-

shells. Some of them are found on the backs of old abalone shells, while others cling to rocks or algæ. They are generally slender and horn-shaped, and so minute that a microscope is needed to observe them satisfactorily. Since they are too small to be easily identified, they will not be described here, but will be mentioned in the List, for the guidance of those who wish to pursue the subject of the identification of the minute mollusca.

Fig. 240

Fumínicola fúsca, Hald, the Tawny Flood-shell, Figure 240, inhabits rivers, as its name indicates. The shell is about the size of a pea, quite solid, with a short, three-whorled spire. The operculum is horny, and the color is greenish. The figure was drawn from a specimen found in Malad River, Utah.

Flumilícola nuttalliána, Lea, Nuttall's Flood-shell, Figure 241, probably inhabits the entire Columbia Valley. The shell is longer and more slender than that of the last species, greenish-brown without, whitish within. The shell is from one-fourth to one-half an inch in length. This species includes the old species, *F. hindsii*, Baird.

Fig. 241

Fluminícola vírens, Lea, the Green Flood-shell, is a northern species, found in Oregon, Washington, and on Vancouver Island. It is about one-fourth of an inch long, remarkably thick, green, with inflated whorls and ovate aperture.

Fluminícola columbiána, Hemphill, the Columbia Flood-shell, has a globose shell, with a very short spire; dark olive or brown color, the four

whorls separated by a deep suture. The last whorl has a narrow ledge below the suture. It is found in the Columbia near Wallula, and the Snake River near Weiser.

Paludéstrina longínqua, Gld., the Desert Paludestrina, (Amnicola longinqua), is found fossil on the Colorado Desert, also living in various parts of Arizona, Utah and Nevada. The little shell is about an eighth of an inch long, a tenth of an inch wide, and is reckoned as being very variable.

Paludéstrina stearnsiána, Pilsbry, Stearn's Paludestrina, has a minute shell, less than 3mm. in length. It is thin, corneous, ovate, glossy, with a rather obtuse apex. It is found chiefly in small streams around Oakland, Cal.

Paludéstrina (Tryónia) prótea, Gld., the Variable Paludestrina. Innumerable specimens of this little shell are found on the Colorado Desert in a sub-fossil form, bleached white. The shell is slender, about 4mm. long, the whorls rounded and distinct, and the aperture small.

Paludéstrina (Tryónia) clathráta, Stimp., the Trellised Paludestrina, greatly resembles the last species and is found in connection with it, but is easily recognized by the transverse ribs which run across its slender whorls.

Pomatiópsis califórnica, Pils., the California Potamiopsis, is found around San Francisco and Oakland. The shell is turreted-conic, umbilicate, rather thin, chestnut-brown. The whorls are very convex, separated by deep sutures; length, 5mm.

Valváta vírens, Tryon, the Green Valve-shell, Figure 242, has a turban-shaped shell about 5mm. in diameter. Color, bright green; umbilicus wide, operculum circular. From Clear Lake, California.

Fig. 242

Paludinélla newcombiána, Hempl., Newcomb's Paludinella, has four distinct, rounded whorls. The shell is thin, smooth, and is covered with a brown epidermis. Aperture nearly circular, length 5mm. These mollusks are amphibious, living in marshes near the sea. From Humboldt Bay, Cal.

Truncatélla califórnica, Pfr., the California Looping-snail, lives about salt marshes and upon seaweeds and stones. The little cylindrical shell is smooth, light brown in color, with a horny operculum, and is less than a quarter of an inch in length. The surface is smooth, and there are distinct sutures between the whorls.

And now, having studied the shells of the rivers and streams, we will go back to old ocean, and find a few more families of mollusks awaiting our attention. And first we come to a group of shells which are somewhat peculiar in shape, having internal parts that are quite distinct.

Fig. 243

Figure 243 gives us an inside view of the tent-shaped shell of *Crucíbulum spinósum,* Sby., the Cup and Saucer Limpet. The saucer is more or less deep, brownish in color, and set on the outside with numerous spines. The cup is small, white,

and triangular. The species assumes many forms, and is sometimes almost white and free from spines. Its home is to the south of Monterey Bay.

Calyptræa mamilláris, Brod., the Chinese Hat, has a white shell, of a low conical shape, running up to a point, while inside there is a twisted deck, the whole thing being the size of a medium button. Northern, though occasionally found south.

There is a large group of shells whose shells are somewhat turtle-shaped, with a floor built over a part of the lower surface. When turned over, they somewhat resemble a Chinese slipper, with a place for the toes of the wearer's foot. So apparent is the resemblance that they are universally called Slipper-shells.

Fig. 244

Crepídula adúnca, Sby., the Hooked Slipper-shell, Figure 244, is perhaps the commonest species. The apex is strongly recurved, suggesting the name, and the surface is brown, though the deck is white. Living specimens may often be found growing upon other shells, and sometimes they are piled one upon another three deep. Young shells often have the apical hook quite pointed.

Crepídula ónyx, var. *rugósa,* Nutt., the Onyx Slipper-shell, somewhat resembles the last, but in favorable locations it grows to a much greater size. The surface is somewhat roughened or shaggy, and the apex is on the very edge of the shell. Beautiful specimens are found in San Pedro Bay, some of them measuring 55mm. in length, the inside being colored a dark, glossy

brown, while the deck is as white as the purest marble.

Fig. 245

Crepídula navicellóides, Nutt., the White Slipper-shell, Figure 245, may easily be recognized by its color, its flattened shape, and by the very thin and delicate deck, which is shown in the engraving. Sometimes this mollusk makes its home upon the rock, and the back of his shell becomes rough and discolored; while again live specimens may be found within the aperture of a dead spiral-shell, and then the slipper is smooth, curved, elongated, and almost transparent.

Crepídula lessónii, Brod., Lesson's Slipper-shell, resembles a long, narrow specimen of the last species. The shell, however, is thickened by a number of layers, partly detached at their edges. The color is white. There is also a short and heavy variety known as var. *explanáta,* Gld., which some consider as a distinct species.

A small species of this extensive genus is named *Crepídula dorsáta,* Brod., the Wrinkled Slipper-shell. It is nearly circular, thin and flat, with a small, curved, and partly detached deck. The wrinkled brown and white shell is about half an inch across.

Crepídula aculeáta, Gmel., the Prickly Slipper-shell, is a small southern form. The yellowish-white shell has a low apex, curved to one side, and is diversified by many irregular radiating ribs.

Cápulus califórnicus, Dall, the California Cap-shell, is a new and fine species, specimens of which

are occasionally found in San Pedro Bay, usually clinging to the outside of a large Pecten. In shape it resembles a very large Crepidula adunca, but there is no deck inside the shell. Externally it has a brown epidermis, somewhat shaggy, while within it is beautifully white. Its length is 40 millimeters.

There is a series of white shells, dead specimens of which are abundant, which present a rather puzzling aspect, and which vary greatly in outward appearance. They are not spiral, but appear like hollow cones, more or less flattened, with the apex to one side of the center. Some of them are singularly like a horse's hoof in shape, while others resemble Figure 246, which represents the species named *Amálthea antiquáta*, Linn, the Ancient Hoof-shell, (Hipponyx antiquatus). Some specimens are less flattened than the picture, but all are more or less rough and scaly externally, while within you can see the muscle-scar in the shape of a horse-shoe. The color is white, and the diameter is about half an inch. Occasionally living specimens may be found with a shelly base attached to a rock, secreted by the animal's foot.

Fig. 246

Amálthea cranióides, Cpr., the Flat Hoof-shell, resembles the last species, but has a still flatter shell, with the apex somewhat near the center instead of at one side.

Amálthea túmens, Cpr., the Sculptured Hoof-shell, (Hipponyx tumens), has a much more regular shell than either of the others. The apex is

recurved, and the lower part of the shell is somewhat bearded. Radial lines run from the apex to the edge, and are crossed by lines of growth. Some specimens greatly resemble a short "horn of plenty." These shells are seldom over half an inch in length.

Figure 247 represents a large shell named *Polynices (Lunátia) lewísii,* Gld., Lewis's Moon-shell. It is a member of the Natica family, all the members of which are distinguished for their ferocious nature, and which might well be called snails of prey.

Fig. 247

Plowing along through the wet sand by means of its enormous foot, it no sooner reaches an unfortunate clam than the flint drill which it carries in its mouth is stretched out, and begins to accomplish its work of destruction. The helpless clam has no means of flight from such an enemy; and if its hard shell is not a sufficient protection, it is in a sad case indeed. And in truth, the case is sad, for the limestone shell is no match for the silica drill, and when once it has reached the savory meat inside, the robber makes short work of his victim. A high-handed proceeding, no doubt; but then, it contrasts rather favorably with our way of opening clams and oysters.

The size of this shell varies greatly with its age and condition. Specimens have been found as large as six-inch globes, but such giants are not common. They are ordinarily the size of average apples. The color is yellowish-white and the form spheroidal; the surface is nearly smooth, and the umbilicus is large.

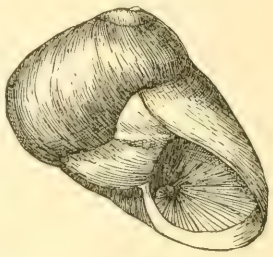


Fig. 248

Polynices (*Nevérita*) *recluziána*, Petit, the southern Moon-shell, Figure 248. This species is a southern form, more smooth and less globular than the last, and is easily identified by the thick, heavy patch of enamel which extends down the columella, and nearly or quite fills the umbilicus. The shell is very solid and strong. In color it varies between brown and white. Its average length is perhaps two inches, though many specimens are smaller. The large operculum is thin and horn-like, without any trace of solid shell.

Nática cláusa, Brod. and Sby., the Closed Natica, is found in British Columbia and northern waters generally. It resembles Figure 247, but is easily distinguished by its closed umbilicus and its shelly operculum.

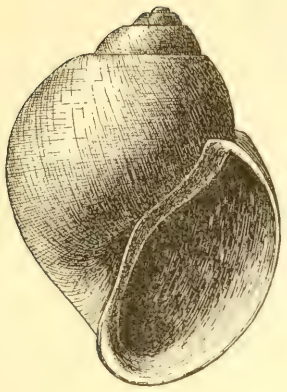


Fig. 249, x $\frac{3}{5}$ (*)

Amaurópsis purpúrea, Dall, the Purple Moon-shell, Figure 249, has a purplish shell, though the patches of enamel near the aperture are white, while the periostracum is olive, with darker streaks. It reaches a length of two inches, and it is found in northern waters, as far as Point Barrow.

Sigarétus débilis, Gld., the Frail Sigaretus, has a delicate, pure white shell, very flat, with a small spire and a very large aperture. The surface is beautifully sculptured by fine rays crossing the lines of growth. Its breadth is an inch or more, and its home is in the south.

Eunaticína oldroydii, Dall, Oldroyd's Natica, resembles Figure 247 in shape, but is much thinner and more delicate, and is marked with almost microscopic sculpturing. It has been dredged at several places along the California shore, but is still a rare species. My specimen from Monterey measures 35mm. in height.

Velutína lævigáta, Linn., the Light Velvet-shell is our next species, and its little shell is shown in Figure 250. The color is light brown, and the aperture is nearly circular. In fresh specimens a velvet-like epidermis covers the shell. It lives in northern waters.

Fig. 250

Fig. 251

Lamellária steárnsii, Dall, Stearn's Lamellaria, Figure 251. This little shell is rather poorly represented in Figure 251. It is pure white, very thin, and has so large an aperture that the interior of the shell is plainly visible. During the life of the animal the shell is wholly covered and concealed by the white, translucent, soft parts of the living creature.

In *Lamellária diegoénsis,* Dall, the San Diego Lamellaria, the soft parts are bright red in color, and the little shell is 17mm. in diameter.

The west coast of America abounds in limpets. Some species cling to rocks which are seldom covered, others live half of their lives under water, while a few must be sought at very low tide. Their dead shells are very common objects along the coast, for they are liable to fall victims to some wandering crab, if they become washed from their footing. Though they creep around somewhat they usually return to the same spot to roost, and the protecting shell is seldom lifted to any considerable distance above the object to which they cling, and when at all disturbed they close it down with force and rapidity. In an especial manner these helpless animals must depend on their thick, hard shell to protect them from injury.

Acmæa spéctrum, Nutt., the Ribbed Limpet, lives far up on the rocks, where it receives only a few splashings at high tide. It is gray in color, much like the granite to which it

Fig. 252

Fig. 253

clings. Two views are given of its shell, both of which represent unusually large specimens. Figure 252 gives a good view of the shell as it appears from above, while the other figure shows a side elevation of the same. Internally the shell is chalky white with various dark markings, which sometimes bring out "the owl" very distinctly. Look for a picture of that bird in various shells of this class.

Limpets are easily collected if they are suddenly lifted by means of a broad-bladed knife, but if they have been previously startled it is best to let them alone, since you will be likely to break the shell if you persist in your endeavor. In some countries they are eaten, and vast numbers are used by the fishermen as bait. Notice carefully the broad foot, the mantle and gills, and the short head with its mouth and tentacles. If a specimen is dissected, the lingual ribbon may easily be obtained from the mouth, and with a low-power microscope the beautiful rows of teeth may easily be made out. After the animal has been removed from the shell, observe the horseshoe-shaped muscle-scar.

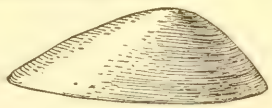


Fig. 254

Acmæa pátina, Esch., the Plate Limpet, Figure 254, is one of the most common kinds. The shell is oval, flattened, with an indistinct apex near the center. From this radiate fine striæ, which are often indistinct. The shell is also often partly overlaid with brownish sea-growths. Young specimens are

sometimes prettily checked with brown and green. Within, the shell is variously marked with brown and bluish-white, with a dark ring around the edge. The common length of the shell is from an inch to two inches.

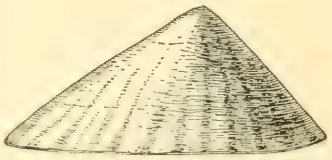


Fig. 255

Acmæa pélta, Esch., the Shield Limpet, Figure 255, is more conical and pointed than the last, and the outside of the shell has about twenty-five blunt, radiating ribs. Externally it is gray or striped, and is sometimes very beautiful; the inside is mainly white, though there is often a dark thread around the edge, and a brown spot in the center. A strange form is sometimes found in which the early growth of the shell seems to have been formed on a different plan from that of the ordinary specimen, for it is smooth, brown, and has almost perpendicular sides like the limpets that grow on seaweeds; but after that it suddenly changes to the ordinary form. It is probable that this was caused by a decided change in the abode of the limpet, perhaps from the seaweed to the rock.

A small, black, conical shell, supposed by Carpenter to be an abnormal growth of the young of this species is now known as *Acmæa ásmi,* Midd., the Black Limpet. It is usually found living on the shells of the Black Turban, and is only one-fourth of an inch in length, while the ordinary shells of the last species are an inch long or more.

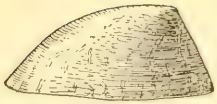


Fig. 256

Figure 256 shows the shell of a large *Acmæa persóna,* Esch., the Mask Limpet. This shell may be distinguished by the position of the apex, which is situated very near one end, making nearly all the slope come upon one side, like the roof of an old-fashioned farm-house. The ribs on the slope of the shell are prominent but irregular. The outside is gray or mottled, and the inside has varying amounts of brown and white. The shell is high arched, but seldom grows to the length of an inch. This species is generally found living where the rocks are seldom covered with water.

Acmæa scábra, Nutt., the File Limpet, is usually of a light brown color externally and white inside. Sometimes the brown is so light that it is almost yellow, while again the surface may be quite dark. The arch of the shell is generally low, and there are fine, sharp, scaly ridges radiating from the apex, making the shell feel like the surface of a fine-cut file. Sometimes it is a little hard to tell a *scabra* from a *patina,* just from the shell, but if you can see the animal you can at once decide, for the head and mantle of the former are black, while those of the Plate Limpet are always white. The ordinary length is about an inch, and the arch of the shell is commonly quite low and the shell thin. Occasionally very aged specimens are found, which have lost all their sculpture, and have become very thick. They can be told, however, by the white appearance of the interior of

the shell, if the fleshy parts have been removed or are lost.

Acmæa mítra, Esch., the White Cap, Figure 257, generally lives below the tide mark, and is seldom found living, though I have occasionally found them at very low water. The shell is pure white, fairly thick, and has a pleasing appearance. Many dead specimens are washed up by the waves, and they always find plenty of admirers. Sometimes the surface of the shell is covered with stony algæ, giving it a mammillary appearance, but generally it is smooth.

Fig. 257

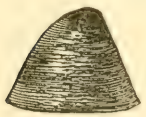


Fig. 258

Acmæa inséssa, Hds., the Seaweed Limpet, Figure 258, (Nacella insessa), is a common species, and may be found living on the flat, central ribbons of the great seaweeds which are so conspicuous along the rocky coast. The sides of the shell are flattened and nearly smooth, and the apex is rounded. The shell is of a dark brown color throughout, and looks as if it were made of horn. It is seldom quite so large as the picture represents.

Acmæa instábilis, Gld., the Unstable Seaweed Limpet, (Nacella instabilis), is larger than the last species. The shell is more limpet-shaped, and it is narrow, compressed at the sides, smooth, brown on the outside and white within. Its length is three-fourths of an inch.

Acmæa depícta, Gld., Painted Limpet, (Nacella depicta), has a very narrow shell, with straight,

flat sides. White, with fine brown stripes radiating from the apex. It is a little shell, being only from 6 to 12mm. in length. It is a southern species, and may be found on grass at low tide.

Acmæa paleácea, Gld., the Chaffy Limpet, (Nacella paleacea), has a very small shell resembling that of the last species, but still narrower. It is brownish, without stripes, and is 7mm. long. *Acmæa trianguláris,* Cpr., is probably a variety of the same species.

The largest limpet to be found on the coast is the one whose shell is shown in Figure 259. Its name is *Lóttia gigántea,* Gray, commonly known as the Owl-shell. On the outside it is usually rough, brown and unsightly; within it is very dark and lustrous, and has a bluish-white center marked with brown.

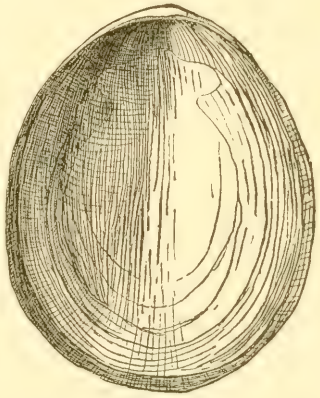


Fig. 259

In many specimens the part within the horse-shoe-shaped muscle-scar greatly resembles a horned owl sitting upon his perch. The shell is rather flat, and the apex is near one end. The length of the shell is sometimes as much as three inches, though commonly it is much less. When properly polished, these shells make very pretty bowls for ornamental spoons.

CHAPTER XI

TOPS AND TURBANS

We now come to a great group of shells quite unlike any that we have previously considered. Most of them are lined with iridescent pearl, and many of the forms are remarkably beautiful. The shells take the form of turbans or tops, and each one has a special front door, which he closes when he desires to be alone. The apertures of all are nearly circular in shape, and they are all to be classed with the vegetarians. We begin with the few that have shelly opercula, and the first one has a very small but very pretty shell.

Fig. 260, x $\frac{3}{2}$

Phasianélla cómpta, Gld., the Pheasant-shell, Figure 260, may sometimes be found alive on sea-grass, though dead shells are more common. When alive, the dull epidermis obscures the beauty of the shell, which is richly painted with little zigzag stripes of red, brown, and white. There is a little white, solid operculum, almost hemispherical in shape, the convex side being outward. The length of the whole shell is from 3 to 6 millimeters.

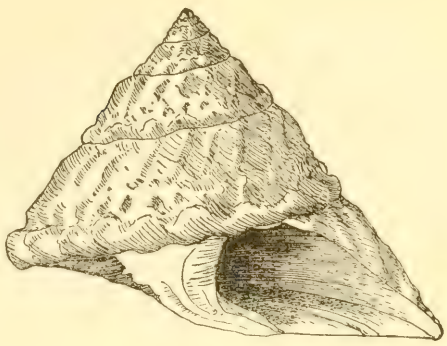


Fig. 261

Pomáulax undósus, Wood, the Wavy Top-shell, Figure 261, is a southern species, which sometimes grows to a great size. The whorls are varied by numerous wavy ridges, and the base is ornamented with beaded circles. The shell is of whitish pearl, and is covered with a brown, fibrous epidermis. The operculum is horny within, while the shelly outer part is strengthened by two heavy, curved ribs. The cut represents a medium-sized specimen, but they sometimes are as much as four inches in height.

Pachypóma inæquále, Mart., the Red Top-shell, Figure 262, (Pachypoma gibberosum), has a big, strong, brick-red shell, with an oval shelly operculum, somewhat like that of the last species, but lacking the ribs. Living specimens are seldom found, but dead shells, somewhat broken, are often thrown up by the waves, especially around sunken ledges. The base of the shell is marked by deep, concentric furrows. The shells of this species are quite variable, some specimens lacking the sculptured fillet shown in the engraving below each

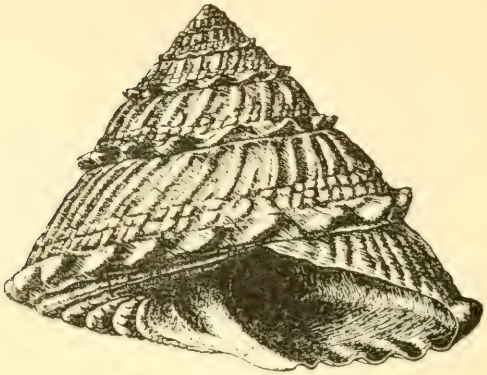


Fig. 262 (*)

suture, while the form of other specimens is much depressed.

From a large shell we turn to a very small one, *Leptóthyra carpentéri*, Pilsbry, the Red Turban-shell, (Leptonyx sanguineus), Figure 263. The whorls are few and are marked with fine, distinct, spiral ridges, and the little operculum is solid and shelly. The color is reddish, sometimes banded or faded. This species may be found at low tide, living upon rocks, but the hermit crabs bring up many more dead specimens.

Fig. 263

Leptóthyra bácula, Cpr., the Berry Turban-shell, (Leptonyx bacula), is shaped like the last, but is smaller, being only one-eighth of an inch in diameter. It is nearly smooth, dark or ashy, and is found in the south, especially around Catalina Island.

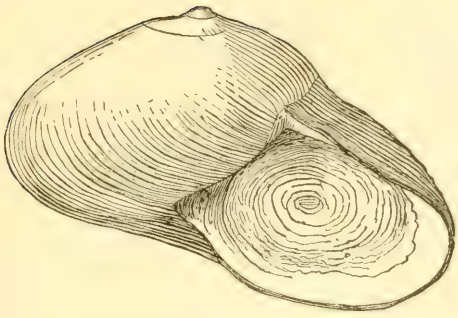


Fig. 264

Norrísia norrísii, Sby., the Smooth Turban-shell, Figure 264, (Trochiscus norrissii), is another southern species. The shell is quite smooth, and is of a rich brown color, the rim of the umbilicus, curiously, being tinted with a bright green. The brown operculum is very shaggy, and the animal is beautifully tinged with red. The figure represents the size of a large specimen.

Fig. 265, x $\frac{4}{3}$

Some of our choicest shells belong to the next genus, and one of the prettiest of all, is named *Callióstoma annulátum,* Mart., the Ring Top-shell. Figure 265 represents a large specimen of this shell, which is thin and delicate, light brown in color, while the sutures are marked with a rich line of purple, and the whorls are traced with sculptured points. It is seldom found on the beach, but is obtained from the seaweed at some distance from the shore. Too delicate to bear the beating of the surf upon the rocks, its home is in deep water, where it clings to long seaweeds near

the surface, or, when the weather is too rough, it sinks to more quiet abodes.

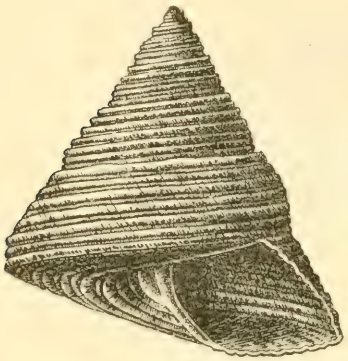


Fig. 266, x $\frac{1}{3}$ (*)

Quite similar in general form and habits is the Channeled Top-shell, *Callióstoma canaliculátum,* Mart., Figure 266. Its shape is strictly conical, and the flattened whorls are girdled with deep, spiral channels, which lie between raised ridges. The surface is ash-colored, though the shell is rainbow-tinted within. The thin exterior layers may very readily be removed by a weak acid, if one wishes to examine the deeper structure of the shell.

Figure 267 presents to us another shell, *Callióstoma costátum,* Mart., the Blue Top-shell. This species is smaller than either of the preceding members of the genus, and lives nearer the shore. Hence we would naturally expect to find that it had a thicker and stronger shell than the others, and in this we are not disappointed. It has four rounded whorls, marked with fine spiral ridges. The thin, reddish brown outer coat is readily removed, showing the blue pearly layer underneath.

Fig. 267

I have found very fine living specimens hanging

upon the roof and walls of some rock grotto which had been left by the early morning tide. I have also gathered them from the long seaweeds which grow near the rocky shore. The length of one of these shells is about three-quarters of an inch, the operculum is perfectly circular, and the aperture of dead shells is often inhabited by a thin variety of White Slipper-shell.

Callióstoma gemmulátum, Cpr., the Gemmed Top-shell, is of a conical shape, the whorls of its shell being ornamented with strings of granules or beads; each whorl having two principal rows, with several smaller ones. The color of this southern shell is gray, with some dark stripes running down from the apex. Its height is only 15mm. or less.

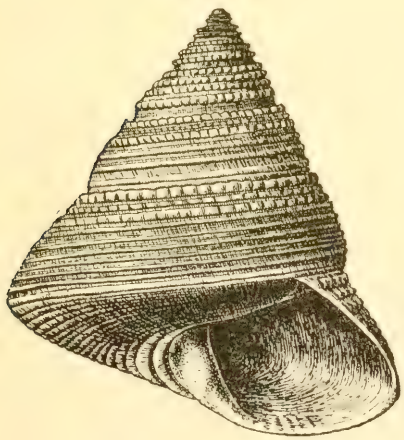


Fig. 268, x $\frac{3}{2}$ (*)

Callióstoma gloriósum, Dall, the Glorious Top-shell, Figure 268, is the name of the fine species which is occasionally found on the Calfornia coast. The engraving shows no color painting, and as it is so much enlarged the gran-

ules appear too prominent. The color of specimens found in Monterey Bay is light salmon, while around the sutures and the angle of the lower whorl is a chain of roundish, dark spots, with the lighter spaces between them. In San Pedro Bay the shells are darker. The height of a grown specimen is fully an inch.

In West Coast Shells this species was called *C. supragranósum,* Cpr. The latter name, however, proves to belong to a rare species, having a much smaller shell, light chestnut-brown in color, with a peripheral circle of alternating chestnut and white spots. It is found only in the south, and may be called the Granose Top-shell.

Callióstoma trícolor, Gabb, the Three-colored Top-shell, is well shown in Figure 269, while Figure 270 gives a magnified view of another specimen. The shell is conical, its five whorls little raised, but marked with delicate spiral sculpturing. The background of yellowish gray is ornamented with fine spiral threads of color, broken into alternate joints of purple and white, thus giving it the three-colored aspect. It is a southern shell, and is obtained by dredging. Figure 269 represents a large specimen.

Fig. 269

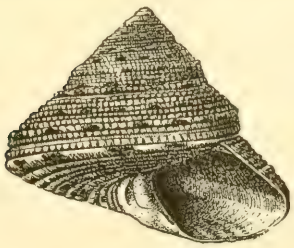


Fig. 270, x $\frac{2}{1}$ (*)

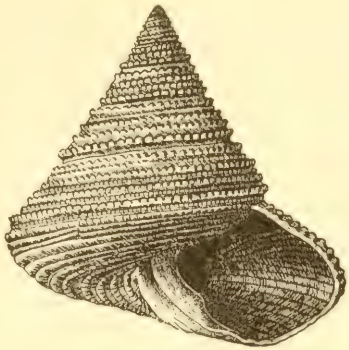


Fig 271, x $\frac{3}{2}$ (*)

Callióstoma variegátum, Cpr., the Variegated Top-shell, Figure 271, was originally described from a very small specimen taken in Puget Sound. Of late years, however, it has been found off San Pedro, where specimens reach an altitude of 28mm. The top of the growing shell is rose colored, and the rest is yellowish white, but as age advances it gradually loses its brightness and appears of a yellowish pink, with pearly iridescence showing through.

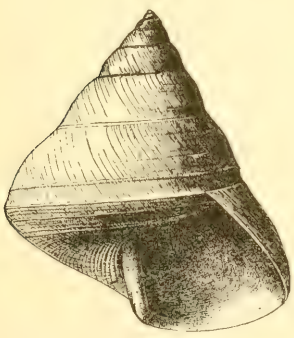


Fig. 272, x $\frac{1}{3}$ (*)

Callióstoma plátinum, Dall, the White Top-shell, Figure 272. This fine species was dredged by the "Albatross" expedition from a depth of about half a mile of water near the Santa Barbara Islands. The shell is large, very thin, polished, and of a whitish color, tinged with green or blue.

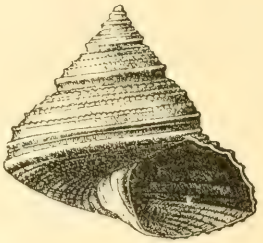


Fig 273, x $\frac{5}{2}$ (*)

Figure 273 represents another rare shell dredged off the coast of southern California. Its name is *Callióstoma turbínum,* Dall, the Turbaned Top-shell. This shell is small, being only 12mm. high. The body of the shell is waxen, showing nacre, and is ornamented with some small flamules of dark brown, not shown in the engraving.

Fig. 274, x $\frac{5}{1}$ (*)

Callióstoma splén-dens, Cpr., the Shining Top-shell. This species has a small shell, about the size of a small pea. It is of an orange-chestnut color, with fleshy or bluish nacre. It is a rare shell, found at Monterey and southward, and has sometimes been considered to be only a variety of C. costatum. It is shown, greatly magnified, in Figure 274.

Thalótia cáffea, Gabb, the Coffee-brown Top-shell, (Turcia caffea). This is a rare shell, resembling a Calliostoma, but it has two folds on the columella, which form a distinguishing mark. The whorls are flattened, the sutures deep and bearded,

the epidermis coffee-brown, and the nacre greenish. Its greatest height is 19mm. Its home is on the California coast.

Margarita pupilla, Gld., the Little Margarita, Figure 275, is a northerner, living in Puget Sound, but sometimes coming further south. It is yellowish brown or ashen in color and its four whorls are marked with spiral ridges. The umbilicus is distinct, but small, and the aperture is nearly circular. Its height is sometimes as great as 13 millimeters.

Fig. 275

Margarita helicina, Fabr., the Helix Margarita, is decidedly arctic in its tastes, living on the shores of northern Europe, eastern America, and around Bering Strait. The shell is umbilicate, thin, flesh colored, polished and shining. Its height is 6mm., and its diameter is a little more.

Margarita lirulata, C'pr., the Lirulate Margarita. This very variable species has a globose-conical shell, solid, purplish, or more or less variegated. The surface sometimes has spiral ridges, or lyræ, though sometimes it is nearly smooth. The suture is impressed, the body-whorl convex beneath, the aperture oblique and very iridescent within. The diameter is 4 or 5mm. This species includes Gibbula succincta, G. parcipicta, and several former species.

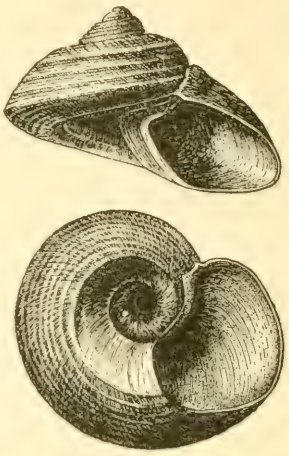


Fig. 276, x $\frac{3}{2}$ (*)

Margarites vorticiferus, Dall, the Northern Margarites, Figure 276, has its home in Bering Sea and adjacent northern regions. The shell is decidedly flattened, and is of a salmon-pink color, very pearly, and has a diameter of 22 millimeters.

We now come to the genus *Chlorόstoma,* which literally means Green-mouth, the reference being to the pearly tint of the aperture. Some of the species are represented by innumerable specimens, while others are comparatively rare.

Fig. 277

Chlorόstoma funebrάle, A. Ad., the Black Turban-shell, Figure 277, is extremely common on the central coast of California. Its shell is strong, for it lives on the rocks midway between high and low tides, where it gets a vigorous lashing by the waves. It is so abundant that I have seen rocks almost black with them, of all ages and sizes.

On my first visit to the seaside I wanted them all, and I gathered and cleaned them for hours. Two very natural results followed; first, that there

remained apparently as many as before; and, second, that on subsequent visits I gathered very few. But whether we collect them or merely watch their movements and study their habits, they soon become like old friends to anyone who has learned the pleasant art of putting himself in sympathy with the lower animals.

The color of the shell is dark purple, almost black on the outside, with a greenish white pearly layer beneath. The whorls are four in number, of which the uppermost ones are often somewhat eroded. The body-whorl is puckered near the suture, the umbilicus is nearly closed, and the columella is set with two little white knobs near its base. The common length of the shell is less than an inch, but sometimes old specimens are found which are considerably longer.

Variety *subapértum,* Cpr., differs in having more prominent spiral ridges, which are usually more roughened, and in having a prominent umbilical pit. It lives in the Vancouver district.

Chlorόstoma gallína, Fbs., the Speckled Turban-shell, Figure 278, is a southern species, with a solid shell, mostly black in color, but finely mottled with a lighter shade, like the feathers of a speckled hen, as its name indicates. Var. *tincta,* Hempl., has a streak of yellow on the base, just below the columellar teeth.

Fig. 278

Fig. 279

Chlorόstoma brúnneum, Phil., the Brown Turban-shell, Figure 279, is a fine species, living on the rocks exposed at very low tide or on the seaweed. It has a handsome, rich brown shell, with a portion of white around the aperture. The lines of growth are very oblique, and are easily noted. Even the dead and worn shells preserve their brown color, and can be easily recognized. The figure represents a large specimen, though old ones are sometimes found much overgrown.

Chlorόstoma aureotínctum, Fbs., the Gilded Turban-shell, is a southern species with a shell resembling the last, but the whorls are banded by a few very heavy, rounded, spiral ridges, with wavy crossings. The shell is gray or nearly black, while the large umbilicus is marked with a bright yellow stain, which gives the species its name. The height of the shell is about an inch.

Chlorόstoma monteréyi, Kien., the Monterey Turban-shell, (C. pfeifferi). The shell of this rare species is strictly conical, with whorls almost perfectly flat. The base likewise is flat and circular, with almost obsolete spiral lines. The columella does not spread around the umbilicus, which is funnel-shaped, white within, and its edges defined by an angle. The color is light brown or olive, and the height of the shell, which about equals the diameter, is an inch or more.

Chlorόstoma púlligo, Mart., the Dusky Turban-shell, much resembles the last species. Its seven whorls are flattened, its base slightly convex, not lined, obliquely streaked, concave and white around the deep and wide umbilicus, which gradually expands and is partly covered by a white callus, and has no spiral ridge within. The color is dull purplish or brown, often orange when worn. The height of a large specimen is 35mm., breadth, 32-mm. Specimens from Monterey are dark red and distorted.

Fig. 280

Chlorόstoma virídulum, var. *ligulátum,* Mke., the Banded Turban-shell, Figure 280, (Omphalius fuscescens). It has a strong, solid turban-shaped shell, whose rusty brown whorls are banded with raised spiral lines. These lines are broken or beaded, and sometimes are dotted with black, giving the shell a very characteristic appearance.

The operculum, as in nearly all the species of this group, is thin, horny and circular. The umbilicus is large and distinct, the aperture circular, and marked below with rounded knobs.

Solariélla peramábilis, Cpr., the Lovely Solariella, has a small, conical shell, which is very ornate, with delicate sculpturings. The umbilicus has three internal spiral lines, crossed by lirulæ, and even the operculum is sculptured. The height is about 15mm. It has been dredged in moderately deep water off Catalina Island.

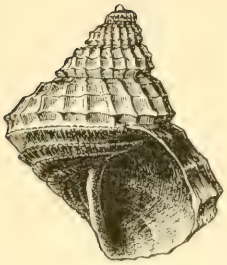


Fig. 281, x $\frac{2}{1}$ (*)

Solariélla oxybasis, Dall, the Pointed Solariella, Figure 281, has an acute spire, a small umbilicus, and an angulated aperture. Its altitude is 13.5mm., and it was dredged off the Santa Barbara Islands.

Turcícula bairdii, Dall, Baird's Turban-shell, Figure 282, is one of the finest deep water species that has recently been discovered. The shell is large, thin, somewhat eroded at the apex and covered elsewhere with a light yellowish-brown epidermis, slightly inclined to greenish. Many specimens were obtained by the "Albatross" expedition off San Clemente Island, in water 300 or 400 fathoms deep. Some specimens are even larger than the figure, which represents one of average size.

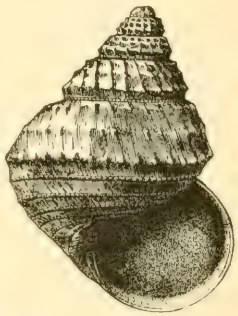


Fig. 282 (*)

Fig. 283, x $\frac{2}{1}$ (*)

Gíbbula canfiéldi, Dall, Canfield's Turban-shell, Figure 283, is an extremely rare shell. In fact, only two recent specimens are known; one of which was collected at Monterey by Dr. Dall, and the other by Mr. Button. It occurs also as a

fossil. Possibly some reader of this book may discover it anew. The color of the shell is pearly, with bronze-yellow pencilings arranged obliquely to the suture. The height is ten millimeters.

Halístylus pupoídes, Dall, the Pupa Sea-style, Figure 284, is another species that is seldom found in California, though it is plentiful in British Columbia. It has a little shell only 6mm. long, and its appearance is well shown in the engraving.

Fig. 284, x $\frac{7}{1}$ (*)

Liótia fenestráta, Cpr., the Windowed Liotia, has a small, flattened, whitish shell, cut into numerous square pits, by the crossing of ribs and lines. Its diameter is one-eighth of an inch.

Liótia acuticostáta, Cpr., the Sharp-ribbed Liotia, is smaller than the last, less flattened, and is marked with sharp, spiral ridges, but without cross-lines; its color is whitish.

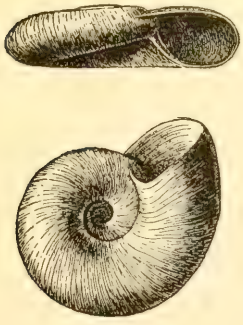


Fig. 285, x $\frac{5}{1}$ (*)

Vitrinélla williamsóni, Dall, Williamson's Vitrinella, Figure 285, has a small, white, depressed shell, 5.5-mm. in diameter. Its surface is polished. It was found on the beach at San Pedro, and was named in honor of Mrs. M. Burton Williamson, of Los Angeles.

CHAPTER XII

PIERCED SHELLS AND CHITONS

We have now come to the largest and finest shells on the coast. They are locally known as abalone shells, while the translation of the scientific name makes them "Sea-ears."

Figure 286 represents our most beautiful species, *Haliótis fúlgens*, Phil., the Green Abalone,

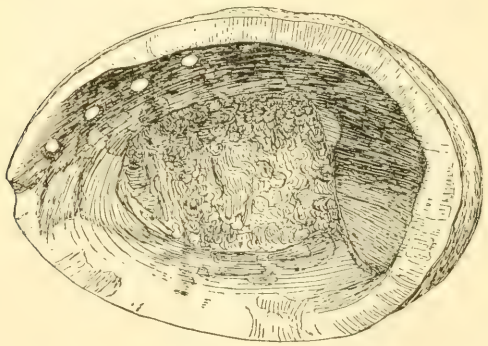


Fig. 286

(H. splendens). The shells of this genus are spiral, but extremely flattened, and the diminutive spire is almost concealed at one end of the body whorl, while the oval aperture is nearly as long and broad as the shell itself.

Near one edge of the shell is a series of holes, which serve as outlets for the water which has

passed over the animal's gills, together with any waste particles that may be thrown off from the various organs. As the shell increases in size, some of the holes become closed from the inside, while new ones are formed at the edge of the growing shell.

If we look within we shall find the most highly colored portion of the shell near the center, where the huge muscle which controls the foot has been detached. This great foot can cling to a rock with surprising force, and the animal must be taken unawares if an easy conquest is expected. The internal organs are very interesting for dissection, particularly the mouth with its long, ribbon-like tongue, thickly set with flinty hooks, or teeth. By means of these teeth the animal rasps its vegetable food into fine shreds fit for swallowing. This lingual ribbon in a good-sized specimen is one-fourth of an inch wide, and three inches long.

This species is essentially a southerner. I have seen one living specimen at Monterey, but they are seldom found so far north. The shell is quite thin, and is diversified externally by low spiral ridges of a dark and dull color.

Within, a whole rainbow is condensed in one of these magnificent shells, though the shades of green are most conspicuous. The coloring of the center is particularly fine, resembling a peacock's tail. There are about six open holes near one side of the shell, and its length is about the same number of inches.

Var. *walallénsis*, Stearns, occurs at Gualala, a small seaport in Sonoma Co., Cal. It is more elongate and flattened than the typical form, and it has a paler nacre. Length, 100mm., breadth 68 millimeters.

Haliótis ruféscens, Swains., the Red Abalone, Figure 287. The beauty of these shells has caused them to be very widely distributed, and though their abundance makes us somewhat careless of them, still, they are among the most beautiful objects ever gathered from this coast. The outer layer of the shell projects over the pearly inner layer, and makes the fine red edge, so much prized in perfect specimens. The back is somewhat roughened, and is often overgrown with vegetation. The holes are large, usually three in number, and the muscle-scar is prominent. The shell sometimes grows to a length of nine inches.

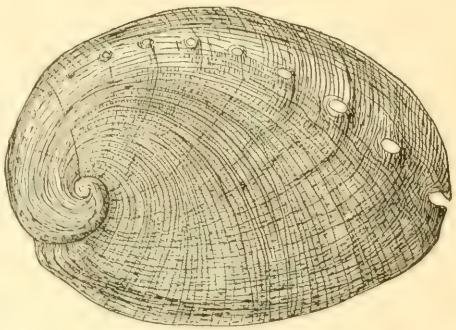


Fig. 287

All parts of this mollusk are valuable. The Chinese dry the meat and use it for food, and it must be confessed that the great muscle makes a most delicious soup. The shells are sold by the ton, and are largely exported to Europe, where

they are made into buttons, and used for various kinds of inlaid work. So persistent has been the warfare against this species that large specimens are much more rare than they were a score of years ago, and laws have been made to protect them from extinction.

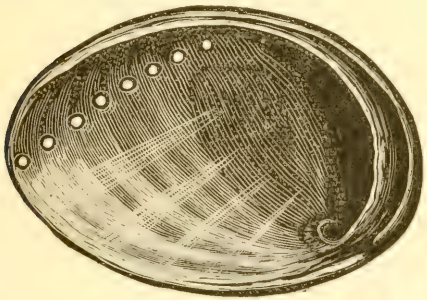


Fig 288

The Black Abalone, *Haliótis cracheródii,* Leach, is shown in Figure 288. It is smaller and more abundant than the last species. The back is quite smooth, marked only by lines of growth. The spire is very short, the holes five to nine in number, and the color is greenish-black without and whitish-pearl-colored within. Live specimens, varying from one-fourth of an inch to six inches in length may be found at low tide, clinging to the rocks, particularly in the most inaccessible cracks, and under heavy boulders.

When examined in a large jar of sea-water, as all of these animals should be if there is an opportunity, a living specimen presents many interesting points for study, particularly its broad foot, its fringed and sensitive mantle, its mouth and eyes and slender tentacles.

Haliótis corrugáta, Gray, the Corrugated Abalone, represents H. rufescens in size and color,

but the shell is nearly circular, thick, high arched, and externally corrugated. It has only two or three open holes, but these are quite large, and the central muscle impression is wide and very brilliant. It is a southern species, and is usually found below low water mark.

Haliótis assímilis, Dall, the Threaded Abalone, is now considered to be a distinct species. It lives in deep water, from Monterey to San Diego. A specimen from the latter city measures four inches in length and three and a quarter in breadth. It has seven open holes, and the exterior of the shell is marked with many threads, like tapestry carpeting. There is a moderate furrow below the line of holes. The spire is short but quite distinct, the body of the shell high arched. Externally the shell is reddish, while the inside is smooth and silvery, without visible muscle-scar. The shell is tolerably thick, and appears very compact and solid.

Quite in contrast with this species is the next, *Haliótis gigántea,* Chem., the Japanese Abalone, which seems to have followed the warm ocean current past the Aleutian Islands, and to have reached the central part of the California coast, becoming smaller as it progressed, so that here it does not deserve its original name, though there seems to be no sufficient reason for separating it even as a variety. My best specimens came from the west coast of Vancouver Island, the largest measuring 5 inches in length. In shape it appears long and narrow, when compared with other species. The

shell is thin, the edge sharp, the spire quite prominent, the surface uneven, and the four open holes large and surrounded by high walls. A deep channel runs under the line of holes. The interior is very iridescent, a light color prevailing, and the muscle-scar is not distinct.

After the shells which have several holes, which we have just considered, there come a number having only one opening, which answers the same purpose. First, we will consider *Puncturélla májor,* Dall, the Greater Puncturella, Figure 289. It is not a common shell, but it shows the features of the genus in a fine manner. Its color is white, its internal margin crenulate, and the posterior slope slightly arched. This fine, large shell was dredged in Bering Sea.

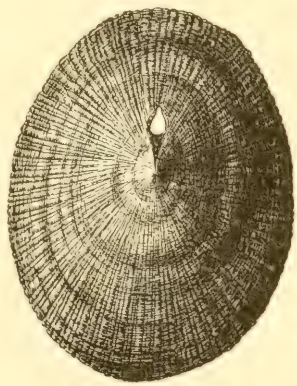


Fig. 289 (*)

Puncturélla galeátea, Gould, the Helmet Puncturella, is an inhabitant of Puget Sound and adjacent waters. The shell is conical and elevated, being about as high as it is broad. The fissure at the summit is narrow, and internally there is a little pit on each side of the hole-channel. Color whitish; length 10mm.

Puncturélla cuculáta, Gld., the Cap Puncturella, is found in Puget Sound, also at Monterey. The

shell is oval, obliquely conical, ribbed, the wedge-shaped puncture opening towards the shorter side. Internally a curved partition separates the puncture from the apex of the shell. The color is pure white within, dirty white without. My specimen from Monterey measures 28mm. in length and 14 millimeters in height.

Puncturélla coóperi, Cpr., Cooper's Puncturella, resembles C. galeatea, but the internal plate is

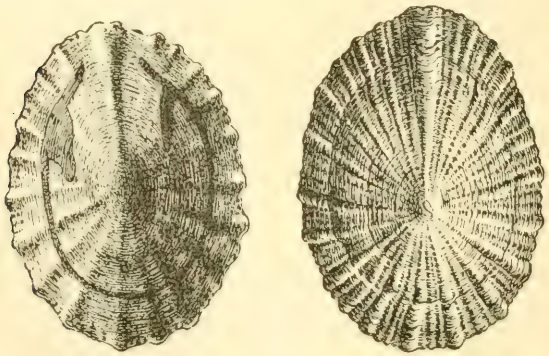


Fig. 290 (*)

solid and plane. Small, about 9mm. in length. Found at Catalina Island.

Figure 290 represents two views of a notable shell, *Subemargínula yátesii,* Dall, Yates' Trough-shell. A few specimens of this species were obtained by Mr. J. K. Oliver of Monterey, from the adjacent bay, one of which was secured by Dr. Yates, who forwarded it to Washington, where it received its name. The shell is large, strong, grayish-white in color, and has many radiating ribs.

Note the trough which extends from the apex to the margin, and which passes between the heels of the horseshoe-shaped muscle-scar. The shell is 51-mm. in length, and 13mm. in height.

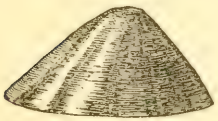


Fig. 291

Figure 291 represents the shell of one of our most common species, *Fissurélla volcáno*, Rve., the Volcano-shell. Dead shells are abundant and attractive, and living specimens, with yellow foot and red-striped mantle, may often be found on the rocks at low tide. The shell is about an inch in length and is oblong-conical in form, while the red stripes on its sides, running down from the small, oblong hole at the top, suggest streams of red-hot lava issuing from the crater of a volcano. The coloring appears plainest on dead shells; the live ones are darker, smoother, and less brilliant.

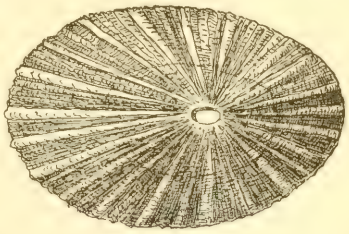


Fig. 292

Fissurídea áspera, Esch., the Rough Keyhole-limpet, Figure 292, (Glyphis aspera). This shell is quite conical, with a small, oval hole at the top, very different from the narrow, oblong slit of the last species. The edge is wrinkled, the color gray on the outside, with dark, purplish rays running down from the apex, while the interior is white. The common size is rather less than that of the cut, though some specimens are much larger.

Fissurídea murína, (Cpr.) Dall, the White Keyhole-limpet, (Glyphis densiclathrata). This species has a much smaller and more delicate shell than the last. It is oblong in shape, with curved ends. The roundish oval hole is one-third of the shell's length from one extremity, and there are numerous fine ribs, checked by concentric ridges. The color is pure white, at least in dead specimens, and the length is about 15mm., a little less than the diameter of a silver dime.

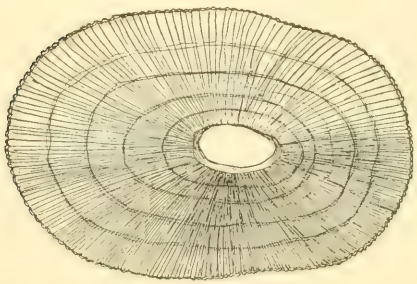


Fig. 293, x ½

Lucapína crenuláta, Sby., the Great Keyhole-limpet, Figure 293. This is by far the largest and finest of the American *Fissuréllidæ.* A small figure of the shell is shown in Figure 293. Though this shell is often some four inches long, the animal is much larger, and somewhat resembles a brick both in shape and size. It has a huge yellow foot and a black mantle, which nearly conceals the white shell which rests upon the animal's back.

This shell is marked by many radiating ribs and concentric lines of growth; it has a large, oblong hole to one side of the center, around which, internally, is a thick rim of enamel. The crenulated or scalloped edge of the shell is a marked feature, and suggested its name. Internally the shell is of a pure, glossy white, but the outside is somewhat

dingy. This mollusk is seldom found near the shore, as it lives wholly below the tides, and must be gathered by dredging.

Lucapinélla callomarginàta, Cpr., the Southern Keyhole-limpet, (Fissurellidæa calliomarginata), is a small species, living below tide-mark, and occasionally found from San Pedro southward. The shell is low arched, with a rather large, oblong hole and roughened rays. The margin is crenulated, the interior white, and the exterior gray, or marked with dark rays; length, 19mm.

Megatebénnus bimaculátus, Dall, the Spotted Keyhole-limpet, Figure 294, (Fissurellidæa bimaculata). These long names apply to a little shell which occasionally grows to a length of 16mm., though many specimens are much smaller. The hole is very large for the size of the shell, and on either end of it are dark rays, making the two spots, from which it is named. Sometimes the whole shell is colored, with darker rays on the sides. The interior is white, though the spots sometimes show through. It is reported from British Columbia as living on the roots of the great seaweed, Macrocystis. The animal is much larger than the shell, part of which is concealed by the mantle.

Fig. 294

There are very odd creatures under the stones which lie along the rim of the ocean. If you go down at low tide and turn the rocks over, one by one, you will be surprised at the number of singular beings which stare up at you in blank amazement, and then rush away into obscure places, as fast as their ten or fourteen legs will carry them.

Others cannot run, but in sheer helplessness wait for your kind decision to do them no harm, and their very inertness appeals to your sympathies. While the saucy crabs waste no time in ceremonies, and the sea-worms creep away as fast as possible, the poor mollusks can only cling to the rock for protection, or curl themselves into the smallest space and the most secure condition which their instinct can dictate.

When you visit the seaside you will want to examine all these harmless little inhabitants of the ocean, and among them you will probably find some specimens of our next group of mollusks, the Chitons. The anatomy of these animals is similar to that of the Limpets, but they seem less highly developed, are more sluggish, and commonly live under stones, away from all scenes of activity.

But the peculiar feature that distinguishes them is the fact that the shell of the Chiton consists of eight parts, instead of a single shield. These parts, or valves, run across the body and overlap one another, like shingles on a roof. They are highest in the center, and they end in a leathern mantle which runs around the body, and which is highly contractile. This being the case, the Chiton shells cannot be preserved with the same ease as those of the Limpets, for the mantle must be dried while the valves are in their natural position.

Probably the best way to prepare fine specimens is to bind the living animal upon a piece of lath, as it rests expanded in a pan of sea-water. It

can then be placed in warm fresh water, and after the lack of salt has destroyed life, and the muscles have lost their contractility, the animal may be unbound, the viscera removed with a sharp knife, and the parts to be preserved be placed in a flat position to dry.

There are a large number of species of Chitons found on this coast, and to attempt to describe them all would be beyond the scope of this work. They will all be mentioned in the List, with the approximate localities, many of which are remote from most collectors. The best work to consult for full descriptions is the Manual of Conchology, published by the Philadelphia Academy of Natural Sciences, Vols. XIV and XV.

Lepidopleúrus néxus, Cpr., the Joined Chiton, has a small, whitish-ashen shell, with valves gothic arched. Length, 7.5mm.; dredged near Catalina Island.

Lepidopleúrus internéxus, Cpr., the Inter-joined Chiton, has a similar shell, but is smaller, and orange-colored. Length, 4.5mm.; from Santa Barbara.

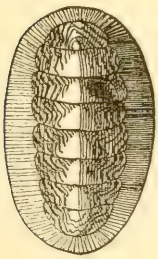


Fig. 295

Tonicélla lineáta, Wood, the Red-lined Chiton, Figure 295. This species is a beautiful representative of this group of mollusks. The valves are smooth, moderately arched in the center, and are of a light reddish color. This background of color is crossed by wavy or zigzag lines of dark brown, bordered above with

white, making the fresh specimen an object of great beauty. The mantle border is smooth, thin, delicate, and is of a yellowish-brown color. Length, about an inch.

Tonicélla marmoráta, Fabr., the Marbled Chiton, has an oblong shell with valves elevated and rather acutely angled. Color, buff, closely speckled with dark red; surface apparently smooth, but microscopically granulated; length, 27 to 40mm. This species lives in the Atlantic and also in the North Pacific.

Tonicélla submarmórea, Midd., the Red-spotted Chiton. Valves rather depressed, apparently smooth, microscopically full of granules; color, rosy or yellowish white, painted with spots and flamules of red; length, 38mm. From Fuca Strait past Aleutian Islands to Japan.

Trachydérmon (Cyánoplax) hartwégi, Cpr., Hartweg's Chiton, (Chaetopleura hartwegi), has a low oval shell, very closely and microscopically granulated, and bears wart-like granules irregularly scattered over the surface. Externally, dull, olive green; internally, intense blue-green; length, about an inch. Found along the whole coast from Vancouver Island southward.

Chaetopleúra gémmea, Cpr., the Gem Chiton, is found at Monterey, Cal. The shell is oblong, elevated, red, olive-ashen, or yellow. The girdle is narrow, leathery, sparsely clothed with short hairs that are easily rubbed off. The valves are not smooth; length, 16mm.

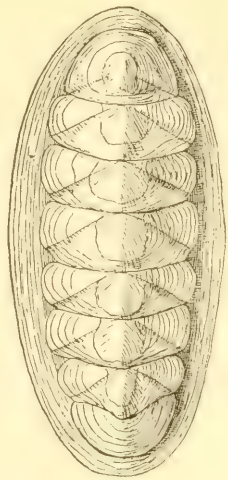


Fig 296

Ischnochíton magdalenénsis, Hds., the Gray Chiton, Figure 296, (Stenoradsia magdalenensis). This large and very common Chiton may be found under rocks at low tide, and can at once be recognized by its worn or roughly sculptured, low-arched valves, which are whitish internally, and gray or somewhat tinted externally. The mantle border is darker, and is covered with minute, solid scales. The foot of the animal is yellow. When taken from the rock it has a habit of curling up into a ball. The figure represents a good-sized specimen.

Ischnochíton conspícuus, Cpr., the Conspicuous Chiton, resembles the last species, but is larger, more richly colored, with pinkish valves, while the mantle is densely beset with short bristles, giving it a velvety appearance. The length of this southern species is sometimes over 90mm.

Ischnochíton merténsii, Midd., the Red Chiton, (Lepidopleurus mertensii), has an oval, elevated shell, with angular dorsal ridges and straight side slopes. The color is red, varying from orange to dark red-brown, and it is sometimes blotched with white. The valves are richly sculptured and are very beautiful when examined with a lens. The mantle border is covered with fine rounded scales;

length from an inch to an inch and a half. It is essentially a northern species, reaching from Sitka to Monterey.

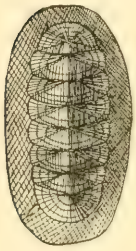


Fig. 297

Ischnochíton reguláris, Cpr., the Regular Chiton, Figure 297. This is truly a regular structure, for the constant breadth is half the length, and the ends are semi-circles. The valves are sharply arched and are marked with very fine sculpturing. By the aid of a lens the border is seen to resemble very fine beadwork. The color is olive or slaty blue, and the interior is light blue; length, 35 millimeters.

Callistochíton palmulátus, Cpr., the Palm Chiton. Small, high arched, valves marked with raised sculpturing. The anterior valve has eleven ribs, and the posterior valve has seven very strong ones, bifurcated behind. Its color is dark brown, and its length is 11mm. It is found at Monterey and Santa Barbara. The variety *mirábilis,* Pils., has the last valve enormously thickened. The interior is bluish white. From San Diego.

Callistochíton crassicostátus, Pilsbry, the Thick-ribbed Chiton, has an elevated, oblong shell, the surface lusterless, green or brown. The front valve has seven very strong ribs; the posterior valve is also elevated, the hinged area not higher than the area in front of it. The interior is bluish white; length, 22mm.; found at Monterey.

Fig. 298

Nuttallína califórnica, Nutt., the California Chiton, Figure 298, (Nuttallina scabra), is a common species living high up on the rocks which are left bare by the tides, hiding in crevices which are ordinarily covered by a growth of Fucus. The coarse, rough valves are often much eroded, but where the surface is presented it is of a dark color, and is sculptured with fine granules. The girdle is covered with short, stiff spinelets, of a brownish color. The foot of the animal is reddish, and the interior of the valves is bluish-green. Its length is about 37mm.

The true *Nuttallína scábra,* Rve., the Scaly Chiton, is a southern species, much resembling the last, but having the individual valves very much shorter in proportion to their width. Color of valves lighter, more variegated.

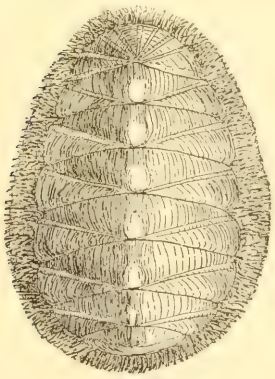


Fig. 299

Mopália muscósa, Gld., the Mossy Chiton, Figure 299, (Mopalia ciliata). This very variable species extends from the far north to San Diego. It may generally be readily recognized by its hairy mantle-border, or girdle, which resembles a fringe of stiff moss. The outside of the valves is sculptured, but this fact is often obscured by growths of seaweed or other organisms. The interior of the valves is

bluish-green, and its length is from an inch to two inches. Good specimens may often be found in rocky places between tide marks, and at lowest water.

Mopália híndsii, (Sby.), Reeve, Hinds's Chiton. The shell of this species is much depressed, and the surface is nearly smooth. The girdle has only a few short hairs. The color is olive, while the interior is white, with short crimson rays under the beaks; its length is two inches. Found in San Francisco Bay and middle California. By some of the best authorities this is considered as only a variety of the last species.

Mopália lignósa, Gld., the Woody Chiton, Figure 300. This fine species is well represented in the figure, which is that of a large specimen. The valves are light green in color within, while on the outside they vary from almost white to dark green. They are also marked with narrow brown lines, which slant from the apex of each valve. The girdle is generally quite rough, but sometimes we find it nearly smooth. This species ranges from Vancouver Island to Monterey. It should be said that specimens have been found connecting this species

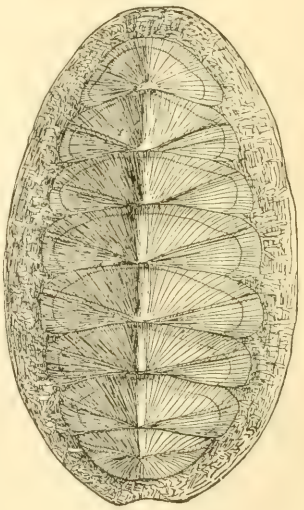


Fig. 300

with the last two, so that by Pilsbry it is considered to be only a sub-species.

Mopália ciliáta, Sby., the Hairy Chiton, has been sadly confused with other species. It is brighter colored than M. muscosa. The girdle is wide, yellow or brown, somewhat clothed with curling, strap-like brown hairs, which bear near their bases a bunch of minute, white, acute spines. Var. *wosnessénskii,* Midd., has a shell elongated, the back roundly arched; color, olive to drab; sculpture, faint. It has been found at Sitka and Olympia. The main species extends along the coast from the far north to Monterey.

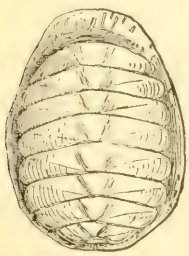


Fig. 301

Placiphorélla veláta, Cpr., the Veiled Chiton, Figure 301. This singular species is more nearly circular than any of its relatives on this coast. At the anterior end the mantle projects considerably, forming a distinct veil, which is set with scattering hairs. The valves are low arched, of a dull reddish color without, but whitish within. Length, 30 to 50mm. It is found from Humboldt Bay southward.

Katherína tunicáta, Sby., the Black Chiton, Figure 302, was named in honor of Lady Katherine Douglass, who first sent a specimen to the British Museum. The shell is oblong, elevated, the valves mainly covered by the black, leathery girdle. This singular arrangement of the parts is so striking that it cannot be mistaken for

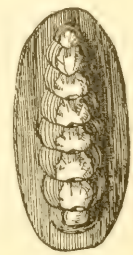


Fig. 302, x $\frac{1}{2}$

any other species. Think of a smooth, black skin, rounded like a whale's back, and set with eight little shelly plates, and you will get the idea. The plates, where they are not covered, are white; elsewhere they are dark brown. The figure shows the appearance of a small specimen, for they sometimes grow to a length of 75mm. This species thrives especially in the far north, but it extends southward to Catalina Island. The soft parts are salmon colored, at least in the northern specimens. It is eaten raw by the natives of the northwest coast.

Amícula pallásii, Midd., the Concealed Chiton, has a shell nearly concealed by the hairy mantle, which is nearly circular, and which covers the back of the animal except for eight small holes. This mantle, or girdle, bears unequal bunches of reddish hairs. Its length is 67mm. It lives in far northern waters.

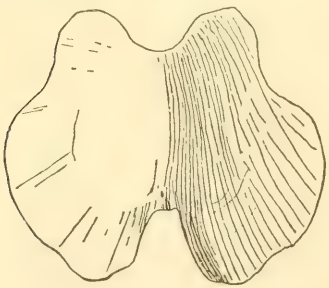


Fig. 303

Cryptochíton stélleri, Midd., the Giant Chiton, Figure 303. We close our descriptions of West American Shells, with an account of this remarkable mollusk. The figure represents only one of the eight white valves, all of which are wholly concealed under the hard, gritty, reddish-brown mantle. These single valves are found much more often than the complete ani-

mal, and from their peculiar shape are often called Butterfly-shells. The whole creature is a huge and heavy affair, six or eight inches in length. When properly cleaned and dried the mantle and valves much resemble a toy boat. This huge Chiton lives all along the western coast, ranging from Japan to the Santa Barbara Islands. Complete specimens are seldom collected from the shore, for it lives just below the lowest tide-mark.

The highest class of mollusks, the Cephalopods, are rather poorly represented on our coast, though one species, at least, exists in great numbers. Shells of a Paper Nautilus, *Argonauta pacífica,* Dall, are sometimes washed ashore on the Santa Barbara Islands. A much more common species is the Octopus, or Devilfish, of our coast, *Octopus punctátus,* Gabb, small specimens of which are frequently captured alive in little tide pools, though in the open sea it grows to startling dimensions.

Ommástrephes tryóni, Gabb, the common Squid of Monterey, is caught in vast numbers by the Chinese fishermen of that city, who go out at night, when the bay is quiet, some of their boats bearing huge torches, while the others are provided with scoop-nets. The silly squids rise to the surface to see the light and are easily captured. Next day they are spread out to dry, and when thoroughly cured they are packed in huge bales and sent to China. The common length of the squid is about eight inches, but specimens of a large size, probably *Ommástrephes gígas,* d'Orb., are occasionally taken at Monterey, which measure fully a yard in length.

LIST OF WEST AMERICAN SHELLS

In the following List an effort has been made to provide a table which will be useful to a variety of readers. By its aid the young collector will be able to classify his specimens under their respective families, while the more advanced student can employ it as a check-list and a reference table.

The references for the most part are to recent books of acknowledged authority, which may be found in any standard scientific library; and while some of the references are not so complete as might be desired, in nearly every instance they will furnish a clue to aid in further investigation.

It would have been easy to materially increase the List by the addition of synonyms and the names of doubtful species, and it would not be surprising if many names have been omitted which some other conchologist would have retained, or would have substituted for those here employed. Many synonyms may be obtained, however, by consulting the references and objectionable changes of name may often be likewise explained. Very likely, however, real errors and omissions will be discovered, and proper corrections and additions will have to be made from time to time. It is hoped, nevertheless, that the list will prove of real assistance to those who are studying the shells of this coast, whether at home or abroad.

Young collectors are advised to use this list freely, in various ways. When the name of a specimen is determined the numeral of the species may be placed on the label, before the name, and the locality may be noted on the margin of the List. The first will assist in an orderly arrangement of specimens, and the second will be a valuable memorandum.

The order of classification essentially follows the "Sketch of General Arrangement," found on page 26, Bulletin 37, United States National Museum, with certain advised changes.

The following abbreviations have been employed:

U. S. N. M.,—for "Proceedings of the United States National Museum"; Arnold,—for "Memoirs of the California Academy of Sciences, Volume III, on the Paleontology * * * of San Pedro, Cal., by Ralph Arnold"; B. C. Bull. 1 and 2,—for "Bulletins of the Natural History Society of British Columbia." Many references are made to volumes of "The Nautilus," and some to "The Manual of Conchology," begun by Tryon and continued by Pilsbry. The other references will be easily understood, the Figures, when mentioned, referring to those on preceding pages of this book.

Class, BRACHIOPODA
Order, **ARTHROPOMATA**
Family, TEREBRATULIDAE
Genus, **Terebratulina,** Orbigny

1. *T. caput-serpentis,* Linné, U. S. N. M., XVII, p. 719.
2. *T. kiiensis,* Dall & Pilsbry, U. S. N. M., XVII, p. 720. Nautilus V, p. 18.

   Family, TEREBRATELLIDAE

   Genus, **Terebratalia,** Beecher
3. *T. occidentalis,* Dall, U. S. N. M. XVII, p. 729.
4. *T. transversa,* Dall, U. S. N. M. XVII, p. 729. Nautilus VII, p. 101.
5. var. *caurina,* Gld., B. C. Bull. 1, p. 41.

   Genus, **Laqueus,** Dall
6. *L. californicus,* Koch, U. S. N. M. XVII, p. 725.
7. *L. jeffreysi,* Dall, U. S. N. M. XVII, p. 725.

   Genus, **Platidea,** Costa
8. *P. aneminoides,* Secchi, San Pedro, 200 fathoms, U. S. N. M. VIII, p. 551.

   Family, RHYCHONELLIDAE

   Genus, **Frieleia,** Dall
9. *F. halli,* Dall, U. S. N. M. XVII, p. 714.

   Genus, **Hemithyris,** Orbigny
10. *H. psittacea,* Linn., B. C. Bull. 1, p. 41.

    Order, **LYOPOMATA**

    Genus, **Glottidea,** Dall
11. *G. albida,* Hinds, Figure 7.

    Class, PELECYPODA

    Order, **PRIONODESMACEA**

    Sub-order, **SOLENOMYACEA**

    Family, SOLENOMYIDAE

    Genus, **Solenomya,** Menke

12. *S. johnsoni,* Dall, U. S. N. M. XVII, p. 712.

Family, NUCULIDAE

Genus, **Nucula,** Lam

13. *N. castrensis,* Hds., U. S. N. M. XV, p. 192. Arnold, p. 95.
14. *N. exigua,* Sby., Nautilus XIII, p. 29.
15. *N. suprastriata,* Cpr., Arnold, p. 96.
16. *N. charlottensis,* Dall, Nautilus XII, p. 10.
17. *N. tenuis,* Mont., Nautilus XIII, p. 29.
18. var. *lurida,* Gld., British Columbia.
19. *N. bellati,* A. Ad., San Pedro, teste Oldroyd.
20. *N. (Acila) lyalli,* Baird, Nautilus VII, p. 101.

Family, LEDIDAE

Genus, **Leda,** Schumacher

21. *L. cellulita,* Dall, Nautilus X, p. 1. XII, p. 10.
22. *L. taphria,* Dall, Nautilus X, p. 70.
23. *L. conceptionis,* Dall, Nautilus X, p. 2.
24. *L. minuta,* Fabr., Arnold, p. 97. Nautilus X, p. 1.
25. *L. hamata,* Cpr., U. S. N. M. XXIV, p. 558.
26. *L. fossa,* Baird, Nautilus X, p. 1. Arnold, p. 96.
27. *L. caelata,* Hds., Nautilus X, p. 1.
28. *L. leonina,* Dall, Nautilus X, p. 21.
29. *L. pontonia,* Dall, Nautilus X, p. 2.
30. *L. extenuta,* Dall, B. C. Bull. 2, p. 8.
31. *L. acuta,* Conr., Nautilus X, p. 19. B. C. Bull. 2, p. 7.

Genus, **Yoldia,** Möller

32. *Y. cooperi,* Gabb, Arnold, p. 99.
33. *Y. ensifera,* Dall, B. C. Bull. 2, p. 9.

34. *Y. montereyensis,* Dall, Nautilus VII, p. 29. B. C. Bull. 2, p. 9.
35. *Y. seminuda,* Dall, B. C. Bull. 2, p. 8.
36. *Y. scissurata,* Dall, B. C. Bull. 2, p. 8. Arnold, p. 99.
37. *Y. lanceolata,* J. Sby., B. C. Bull. 1, p. 52.
38. *Y. limatula,* Say, B. C. Bull. 2, p. 8.
39. *Y. thraciæformis,* Storer, B. C. Bull. 2, p. 8.
40. *Y. arctica,* Gray, B. C. Bull. 2, p. 8.
41. *Y. martyria,* Dall, B. C. Bull. 2, p. 9.

Genus, **Malletia,** Desmoulins

42. *M. faba,* Dall, B. C. Bull. 2, p. 10.
43. *M. gibbsii,* Dall, B. C. Bull. 2, p. 10.
44. *M. pacifica,* Dall, B. C. Bull. 2, p. 11.
45. *M. kennerleyi,* Dall, B. C. Bull. 2, p. 11.

Sub-order, **ARCACEA**

Family, ARCIDAE

Genus, **Arca,** Lamarck

46. *A. reticulata,* Gmel., San Pedro, southward.
47. *A. mutabilis,* Sby., U. S. N. M. XV, p. 192.
48. *A. multicostata,* Sby., U. S. N. M. XV, p. 192.

Genus, **Barbatia,** Gray

49. *B. gradata,* Sby., Nautilus VII, p. 133.

Genus, **Pectunculus,** Lamarck

50. *P. arcodentiens,* Dall, U. S. N. M. XVII, p. 705.

Genus, **Glycymeris,** Da Costa

51. *G. barbarensis,* Conr., Arnold, p. 100.
52. *G. intermedia,* Brod., described in this book.
53. *G. septentrionalis,* Midd., Arnold, p. 100. Far north.

54. var. *subobsoleta,* Cpr., Arnold, p. 100.
Genus, **Limopsis,** Sassi

55. *L. vaginata,* Dall, U. S. N. M. XVII, p. 713.
Sub-order, **NAIADACEA**
Family, UNIONIDAE
Genus, **Margaritana,** Schum.

56. *M. margaritifera,* Linn., U. S. N. M., XIV, p. 105. Nautilus XIII, p. 67.
Genus, **Anodonta,** Cuvier

57. *A. beringiana,* Midd., U. S. N. M. XXII, p. 628.

58. *A. californiensis,* Lea, U. S. N. M. XIX, p. 373.

59. *A. oregonensis,* Lea, described in this book.

60. *A. nuttalliana,* Lea, U. S. N. M. XIV, p. 106.

61. *A. dejecta,* Lewis, U. S. N. M. XIX, p. 372.

62. *A. wahlametensis,* Lea, U. S. N. M. XXII, p. 629.

63. *A. kennerleyi,* Lea, U. S. N. M. XXII, p. 628.
Genus, **Gonidea,** Conrad

64. *G. angulata,* Lea, U. S. N. M. XXII, p. 657.
Sub-order, **MYTILACEA**
Family, AVICULIDAE
Genus, **Avicula,** Lamarck

65. *A. peruviana,* Rve., Southern, barely touching California.
Genus, **Atrina,** Gray

66. *A. oldroydii,* Dall, Nautilus XIV, p. 143.
Genus, **Philobrya,** Cpr.

67. *P. setosa,* Cpr., described in this book.

Family, MYTILIDAE

Genus, **Mytilus,** Linn.

68. *M. stearnsii,* Pils. & Raymond, Nautilus XII, pp. 69 and 70.
69. *M. californianus,* Conr., Figure 14.
70. *M. edulis,* Linn., described in this book.
71. var. *glomeratus,* Gld., this book, p. 32.

Genus, **Septifer,** Recluz

72. *S. bifurcatus,* Rve., Nautilus XII, p. 69.

Genus, **Modiolus,** Lamarck.

73. *M. modiolus,* Linn., Nautilus IX, p. 39.
74. *M. capax,* Conr., described in this book.
75. *M. fornicatus,* Cpr., described in this book.
76. *M. rectus,* Conr., Figure 16.
77. *M. plicatulus,* Lam., Nautilus XIII, p. 86.
78. *M. politus,* Ven., San Pedro, teste Oldroyd.
79. *M. taylori,* Dall, B. C. Bull. 1, p. 51, "Victoria, on coralline, in tide pools."
80. *M. rectus,* var. *flabellatus,* Gld., B. C. Bull. 1, p. 51.
81. *M. opifex,* Say., San Pedro, deep water, very rare.

Genus, **Adula,** H. & A. Adams

82. *A. falcata,* Gld., Figure 17.
83. *A. stylina,* Cpr., described in this book.

Genus, **Lithophagus,** Muhlfeldt

84. *L. plumula,* Hanl., described in this book.

Genus, **Modiolaria,** Beck

85. *M. lævigata,* Gray, Nautilus VII, p. 101.
86. *M. vulgaris,* Gray, Puget Sound.

87. *M. nigra,* Gray, B. C. Bull. 1, p. 51.
88. *M. taylori,* Dall, B. C. Bull. 2, p. 5, Nautilus XII, p. 10.
89. *M. seminuda,* Dall, B. C. Bull. 2, p. 5.
90. *M. vernicosa,* Dall, B. C. Bull. 2, p. 5.
91. *M. denticulata,* Dall, U. S. N. M. 1885, p. 551.

Genus, **Crenella,** Brown

92. *C. decussata,* Mont., Nautilus X, p. 18. U. S. N. M. XII, p. 251.

Sub-order, **PECTINACEA**

Family, PECTINIDAE

Genus, **Pecten,** Muller

93. *P. æquisulcatus,* Cpr., Bull. So. Cal. Acad. Sci., Vol. I, No. 5.
94. *P. caurinus,* Gld., described in this book.
95. *P. diegoensis,* Dall, mostly dredged, southern.
96. *P. hastatus,* Sby., San Pedro, at 200 fathoms.
97. *P. hericeus,* Gld., Figure 19.
98. *P. latiauritus,* Conr., described in this book.
99. var. *monotimeris,* Conr., Figure 20.
100. *P. rubidus,* Hds., northern.
101. *P. vancouverensis,* Whiteaves, Nautilus VII, p. 100.
102. *P. randolphi,* Dall, U. S. N. M. XXIV, p. 559.
103. *P. davidsoni,* Dall, Nautilus XI, p. 86.
104. *P. ventricosus,* Sby., Arnold, p. 114.
105. *P. alaskensis,* Dall, Nautilus XI, p. 86.
106. *P. (Hinnites) giganteus,* Gray, Figure 22.

Genus, **Lima,** Brug.

107. *L. dehiscens,* Conr., Arnold, p. 116.
Genus, **Limatula,** Wood

108. *L. subauriculata,* Mtg., Nautilus XVIII, p. 19. British Columbia; also dredged at Catalina Island.
Sub-order, **ANOMIACEA**
Family, ANOMIIDAE
Genus, **Anomia,** Linn.

109. *A. lampe,* Gray, described in this book.
Genus, **Monia,** Gray

110. *M. macroschisma,* Desh., Figure 24.
Sub-order, **OSTRACEA**
Family, OSTREIDAE
Genus, **Ostrea,** Linn.

111. *O. lurida,* Cpr., described in this book.

112. var. *expansa,* Cpr., described in this book.

113. *O. virginiana,* Lister, described in this book.
Order, **TELEODESMACEA**
Sub-order, **CARDITACEA**
Family, CARDITIDAE
Genus, **Cardita,** Bruguiere

114. *C. subquadrata,* Cpr., Figure 25.
Genus, **Calyptogena,** Dall

115. *C. pacifica,* Dall, U. S. N. M. XVII, p. 713.
Genus, **Venericardia,** Lam.

116. *V. alaskana,* Dall, U. S. N. M. XXVI, p. 951.

117. *V. barbarensis,* Stearns, U. S. N. M. XIII, p. 214. Arnold, p. 128.

118. *V. borealis,* Conr., U. S. N. M. XIII, p. 215. Nautilus X, p. 20.

119. *V. crassidens,* B. & S., U. S. N. M. XXVI, p. 949.
120. *V. gouldii,* Dall, U. S. N. M. XXVI, p. 951.
121. *V. incisa,* Dall, U. S. N. M. XXVI, p. 951.
122. *V. ventricosa,* Gld., Arnold, p. 128.

Genus, **Milneria,** Dall

123. *M. minima,* Dall, U. S. N. M. VIII, p. 534.

Family, ASTARTIDAE.

Genus, **Astarte,** J. Sowerby

124. *A. compacta,* Cpr., U. S. N. M. XXVI, p. 944.
125. *V. polaris,* Dall, U. S. N. M. XXVI, p. 943.
126. *A. rollandi,* Bern., U. S. N. M. XXVI, p. 943.
127. *A. esquimalti,* Baird, Nautilus VII, p. 101.
128. *A. arctica,* Gray, U. S. N. M. XXVI, p. 944.
129. *A. borealis,* Schum., U. S. N. M. XXVI, p. 944.
130. *A. alaskensis,* Dall, U. S. N. M. XXVI, p. 944.
131. *A. fabula,* Reeve, U. S. N. M. XXVI, p. 945.
132. *A. bennettii,* Dall, U. S. N. M. XXVI, p. 945.
133. *A. vernicosa,* Dall, U. S. N. M. XXVI, p. 945.
134. *A. undata,* Gould, B. C. Bull. 1, p. 50.

Genus, **Miodon,** Carpenter

135. *M. prolongatus,* Cpr., U. S. N. M. XIII, p. 217.

Family, CRASSATELLIDAE

Genus, **Crassatella,** Lamarck

136. *C. marginata,* Cpr., described in this book.

Sub-order, **LEPTONACEA**

Family, CHLAMYDOCHONCHIDAE

Genus, **Chlamydoconcha,** Dall

137. *C. orcutti,* Dall, U. S. N. M. XXI, p. 879. West Am. Sci., June, 1900, p. 48.

Family, SPORTELLIDAE

Genus, **Sportella,** Desh.

138. *S. californica,* Dall, XXI, pp. 879 and 885.

Family, LEPTONIDAE

Genus, **Lepton,** Turton

139. *L. meroeum,* Cpr., XXI, p. 879.

Genus, **Ericyna,** Lamarck

140. *E. compressa,* Dall, U. S. N. M. XXI, p. 888.

141. *E. rugifera,* Cpr., U. S. N. M. XXI, pp. 880 and 887.

Genus, **Bornia,** Phil.

142. *B. retifera,* Dall, U. S. N. M. XXI, p. 889. Arnold, p. 136.

Genus, **Kellia,** Turton

143. *K. laperousii,* Desh., U. S. N. M. XXI, p. 880.

144. *K. suborbicularis,* Montagu, U. S. N. M. XXI, p. 880.

Genus, **Serridens,** Dall

145. *S. oblonga,* Cpr., Nautilus XV, p. 144. U. S. N. M. XXI, p. 880.

Genus, **Mysella,** Angas

146. *M. aleutica,* Dall, U. S. N. M. XXI, p. 892.

147. *M. pedroana,* Dall, U. S. N. M. XXI, p. 893.

148. *M. planata,* Dall, U. S. N. M. XXI, p. 892.

149. *M. tumida,* Cpr., U. S. N. M. XXI, p. 881.

Genus, **Lasaea,** Leach.

150. *L. rubra,* Montagu, U. S. N. M. XXI, pp. 881 and 895.

Family, KELLIELLIDAE

Genus, **Turtonia,** Alder

151. *T. minuta,* Fabr., U. S. N. M. XXI, p. 881.

152. *T. occidentalis,* Dall, U. S. N. M. XXI, p. 881.

Sub-order, **LUCINACEA**

Family, THYASIRIDAE

Genus, **Thyasira,** Leach

153. *T. bisecta,* Conr., U. S. N. M. XXIII, p. 789.

154. *T. gouldii,* Phil., U. S. N. M. XXIII, p. 790.

155. *T. barbarensis,* Dall, U. S. N. M. XXIII, p. 790.

156. *T. excavata,* Dall, U. S. N. M. XXIII, p. 790.

157. *T. trisinuata,* Orb., U. S. N. M. XXIII, p. 790.

Genus, **Axinopsis,** Sars.

158. *A. sericatus,* Cpr., U. S. N. M. XXIII, p. 791.

159. *A. viridis,* Dall, U. S. N. M. XXIII, pp. 819 and 791.

Family, DIPLODONTIDAE

Genus, **Diplodonta,** Turton

160. *D. alentica,* Dall, U. S. N. M. XXIII, pp. 795 and 820.

161. *D. orbella,* Gld., U. S. N. M. XXIII, p. 795.

162. *D. subquadrata,* Cpr., U. S. N. M. XXIII, p. 820.

Family, LUCINIDAE

Genus, **Phacoides,** Blainville

163. *P. annulatus,* Reeve, U. S. N. M. XXIII, p. 813.

164. *P. æquizonatus,* Stearns, U. S. N. M. XXIII, p. 813.

165. *P. approximatus,* Dall, U. S. N. M. XXIII, p. 813.
166. *P. californicus,* Conrad, U. S. N. M. XXIII, p. 813.
167. *P. nuttallii,* Conrad, U. S. N. M. XXIII, p. 812.
168. *P. (Here) richthofeni,* Gabb., U. S. N. M. XXIII, pp. 810 and 827.
169. *P. tenuisculptus,* Carpenter, U. S. N. M. XXIII, pp. 813 and 828.

Sub-order, **CHAMACEA**

Family, CHAMIDAE

Genus, **Chama,** Brug.

170. *C. exogyra,* Conr., described in this book.
171. *C. pellucida,* Sby., Figure 46.
172. *C. spinosa,* Sby., described in this book.

Sub-order, **CARDIACEA**

Family, CARDIIDAE

Genus, **Cardium,** Linn.

173. *C. biangulatum,* Sowerby, U. S. N. M. XXIII, p. 390.
174. *C. californiense,* Desh., Nautilus VII, p. 101.
175. *C. corbis,* Mart., Nautilus XV, p. 10.
176. *C. elatum,* Sby., U. S. N. M. XXIII, p. 391.
177. *C. quadragenarium,* Conrad, U. S. N. M. XXIII, p. 389.
178. *C. substriatum,* Conrad, U. S. N. M. XXIII, p. 391.
179. *C. ciliatum,* O. Fabr., U. S. N. M. XXIII, p. 340.

Genus, **Serripes,** Beck

180. *S. laperousii,* Desh., U. S. N. M. XXIII, p. 391.

181. *S. grönlandicus,* Gmelin, U. S. N. M. XXIII, p. 391.

Genus, **Protocardia,** Beyrich

182. *P. centifilosa,* Cpr., U. S. N. M. XXIII, p. 391. Arnold, p. 142.

183. var. *richardsonii,* Whiteaves, U. S. N. M. XXIII, p. 391.

Family, ISOCARDIIDAE

Genus, **Callocardia,** A. Adams

184. *C. lepta,* Dall, U. S. N. M. XVIII, p. 17.

185. *C. stearnsii,* Dall, U. S. N. M. XVIII, p. 17.

Sub-order, **CYRENACEA**

Family, CYRENIDAE

Genus, **Pisidium,** Pfeiffer

186. *P. abditum,* Hald., U. S. N. M. XIX, p. 370.

187. *P. ashmuni,* Sterki, Nautilus XVII, p. 42.

188. *P. compressum,* Prime, Nautilus XVII, p. 84.

189. *P. ultramontanum,* Prime, Nautilus XIII, p. 67.

190. *P. rowelli,* Sterki, Nautilus XVII, p. 80.

191. *P. idahoense,* Roper, Nautilus IV, p. 85.

192. *P. variabile,* Prime, Nautilus IX, p. 102.

193. *P. randolphii,* Roper, Nautilus IX, p. 102.

Genus, **Sphaerium,** Scopoli

194. *S. dentatum,* Haldeman, described in this book

195. *S. occidentale,* Prime, described in this book.

196. *S. solidulum,* Prime, U. S. N. M. XIX, p. 370.

197. *S. striatinum,* Lamarck, Conn. to Alabama and California.
198. *S. nobile,* Gould, Nautilus IX, p. 102.
199. *S. raymondi,* J. G. Cooper, Nautilus V, p. 120; XVI, p. 93.
200. *S. primeanum,* Cless., Nautilus IX, p. 102.
201. *S. lenticulum,* Gould, Nautilus V, p. 120.
202. *S. partumeium,* Say, Nautilus V, p. 120; XV, p. 103.
203. *S. truncatum,* Linsl., Nautilus V, p. 120.
204. *S. sulcatum,* Lamarck, Figure 50.
205. *S. patellum,* Gould, described in this book.

Genus, **Calyculina,** Clessin

206. *C. lacustris,* Müll., Nautilus XVI, p. 93.

Sub-order, **VENERACEA**

Family, VENERIDAE

Genus, **Dosinia,** Scopoli

207. *D. ponderosa,* Gray, U. S. N. M. XXVI, p. 384.

Genus, **Transennella,** Dall

208. *T. tantilla,* Gould, U. S. N. M. XXVI, p. 384.

Genus, **Tivela,** Link.

209. *T. stultorum,* Mawe, U. S. N. M. XXVI, p. 386; XXI, p. 371.

Genus, **Amiantis,** Carpenter

210. *A. callosa,* Conrad, U. S. N. M. XXVI, p. 387.

Genus, **Pitaria,** Romer

211. *P. newcombiana,* Gabb, U. S. N. M. XXVI, p. 387.

Genus, **Cytherea,** Bolten

212. *C. fordi,* Yates, U. S. N. M. XXVI, pp. 390 and 403.

Genus, **Saxidomus,** Conrad

213. *S. giganteus,* Desh, U. S. N. M. XXVI, p. 391.
214. *S. nuttallii,* Conrad, Nautilus XIV, p. 1.
215. *S. brevisiphonatus,* Cpr., U. S. N. M. XXVI, p. 408.

Genus, **Chione,** Megerle

216. *C. fluctifraga,* Sby., U. S. N. M. XXVI, p. 392.
217. *C. succincta,* Val., U. S. N. M. XXVI, p. 392.
218. *C. undatella,* Sby., U. S. N. M. XXVI, p. 392.

Genus, **Venus,** Linné

219. *V. kennicottii,* Dall, U. S. N. M. XXVI, p. 396.

Genus, **Marcia,** H. & A. Adams

220. *M. kennerleyi,* Reeve, U. S. N. M. XXVI, pp. 396 and 406.
221. *M. subdiaphana,* Cpr., U. S. N. M. XXVI, p. 397.

Genus, **Paphia,** Bolten

222. *P. staminea,* Conr., U. S. N. M. XXVI, p. 397.
223. var. *petiti,* Deshayes.
224. var. *laciniata,* Cpr.
225. var. *ruderata,* Deshayes.
226. var. *orbella,* Cpr.
227. *P. tenerrima,* Cpr., U. S. N. M. XXVI, p. 399.

Genus, **Liocyma,** Dall

228. *L. beckii,* Dall, U. S. N. M. XXVI, pp. 399 and 407.
229. *L. scammoni,* Dall, U. S. N. M. XXVI, p. 400.
230. *L. viridis,* Dall, U. S. N. M. XXVI, pp. 399 and 407.

Genus, **Venerupis,** Lamarck

231. *V. lamellifera,* Conr., U. S. N. M. XXVI, p. 400.

Genus, **Psephidia,** Dall

232. *P. lordi,* Baird, U. S. N. M. XXVI, p. 401.
233. *P. ovalis,* Dall, U. S. N. M. XXVI, p. 401.

Genus, **Gemma,** Deshayes

234. *G. gemma,* Totten, U. S. N. M. XXVI, p. 401.

Sub-order, **TELLINACEA**

Family, PETRICOLIDAE

Genus, **Petricola,** Lamarck

235. *P. carditoides,* Conrad, U. S. N. M. VIII, p. 547.
236. *P. cognata,* C. B. Adams, Nautilus XIII, p. 121. Arnold, p. 156.
237. *P. denticulata,* Sowerby, Nautilus XIII, p. 121.

Family, DONACIDAE

Genus, **Donax,** Linne

238. *D. californica,* Conrad, Nautilus XIV, p. 105.
239. *D. lævigata,* Deshayes, Nautilus XIV, p. 105.

Family, PSAMMOBIIDAE

Genus, **Psammobia,** Lamarck

240. *P. californica,* Conrad, Nautilus XIII, p. 82; IX, p. 42.

241. *P. edentula,* Gabb, Nautilus XIII, p. 29. Arnold, p. 168.

Genus, **Heterodonax,** Morch

242. *H. bimaculata,* D'Orb, Nautilus XII, p. 33.

Genus, **Tagelus,** Gray

243. *T. californianus,* Conrad, Arnold, p. 169.

244. var. *subteres,* Conr., U. S. N. M. XV, p. 184.

Genus, **Sanguinolaria,** Lamarck

245. *S. nuttallii,* Conr., Arnold, p. 168. U. S. N. M. VIII, p. 547.

Family, TELLINIDAE

Genus, **Tellina,** Linne

246. *T. bodegensis,* Hinds, U. S. N. M. XXIII, p. 304.

247. *T. buttoni,* Dall, U. S. N. M. XXIII, p. 320.

248. *T. carpenteri,* Dall, U. S. N. M. XXIII, p. 303.

249. *T. idæ,* Dall, U. S. N. M. XIV, p. 183.

250. *T. meropsis,* Dall, Figure 71.

251. *T. modesta,* Cpr., U. S. N. M. XXIII, p. 304.

252. *T. salmonea,* Cpr., U. S. N. M. XXIII, p. 302.

253. *T. santa-rosæ,* Dall, U. S. N. M., pp. 305 and 321.

254. *T. lutea,* Gray, U. S. N. M. XXIII, pp. 304 and 322.

Genus, **Macoma,** Leach

255. *M. alaskana,* Dall, U. S. N. M. XXIII, p. 323.

256. *M. balthica,* var. *inconspicua,* Brod. & Sby., U. S. N. M. XXIII, p. 299.

257. *M. calcarea,* Gmelin, Arnold, p. 161.

258. *M. carlottensis,* Whiteaves, U. S. N. M. XXIII, p. 308.

259. *M. edentula,* Brod. & Sby., U. S. N. M. XXIII, p. 307.

260. *M. expansa,* Cpr., U. S. N. M. XXIII, p. 308.

261. *M. incongrua,* von Martens, U. S. N. M. XXIII, p. 306.

262. *M. inflatula,* Dall, B. C. Bull. 2, p. 11.

263. *M. inquinata,* Desh., U. S. N. M. XXIII, p. 307.

264. *M. identata,* Cpr., U. S. N. M. XXIII, p. 309.

265. var. *tenuirostris,* Dall, U. S. N. M. XXIII, p. 309.

266. *M. krausei,* Dall, U. S. N. M. XXIII, p. 322.

267. *M. leptonoidea,* Dall, U. S. N. M. XXIII, p. 323.

268. *M. nasuta,* Conrad, U. S. N. M. XXIII, p. 307.

269. *M. liotricha,* Dall, U. S. N. M. XXIII, p. 308.

270. *M. secta,* Conrad, U. S. N. M. XXIII, p. 309.

271. *M. sitkana,* Dall, U. S. N. M. XXIII, p. 323.

272. *M. yoldæformis,* Cpr., U. S. N. M. XXIII, p. 309.

273. *M. middendorffii,* Dall, U. S. N. M. XXIII, p. 306.

Genus, **Metis,** H. & A. Adams

274. *M. alta,* Conrad, U. S. N. M. XXIII, p. 306.

Family, SEMELIDAE

Genus, **Semele,** Schumacher

275. *S. californica,* Adams, U. S. N. M. XV, p. 186.

276. *S. decisa,* Conrad, U. S. N. M. VIII, p. 546.
277. *S. pulchra,* Sowerby, U. S. N. M. XIX, p. 378.
278. var. *montereyi,* Dall, Arnold, p. 166.
279. *S. rupium,* Sby., U. S. N. M. XIX, p. 378.
280. *S. rubropicta,* Dall, U. S. N. M. XIX, p. 378.

Genus, **Cumingia,** Sowerby

281. *C. californica,* Conrad, Figure 78.

Genus, **Cooperella,** Cpr.

282. *C. scintillæformis,* Cpr., described in this book.
283. *C. subdiaphana,* Cpr., Arnold, p. 153.

Sub-order, **MYACEA**

Family, CORBULIDAE

Genus, **Corbula,** Lamarck

284. *C. luteola,* Cpr., U. S. N. M. VIII, p. 546. Arnold, p. 181.
285. *C. chittyana,* C. B. Adams, Nautilus XIII, p. 28.

Genus, **Sphaenia,** Turton

286. *S. ovoidea,* Cpr., B. C. Bull. 1, p. 43.

Genus, **Neaera,** Gray

287. *N. pectinata,* Cpr., Arnold, p. 181.
288. *N. californica,* Dall, Nautilus XVIII, p. 20.

Family, MYIDAE

Genus, **Mya,** Linne

289. *M. arenaria,* Linn., Nautilus XI, p. 66.
290. *M. truncata,* Linn., described in this book.

Genus, **Cryptomya,** Conr.

291. *C. californica,* Conr., Arnold, p. 180.

Genus, **Platyodon,** Conrad

292. *P. cancellatus,* Conr., Arnold, p. 179.

Family, SAXICAVIDAE

Genus, **Saxicava,** Bellevue

293. *S. arctica,* Linn., described in this book.

294. var. *pholadis,* Linn., described in this book.

295. var. *rugosa,* Linn., U. S. N. M. VIII, p. 546.

296. *S. norvegica,* Spengler, B. C. Bull. 1, p. 42.

Genus, **Panopaea,** Ménard

297. *P. generosa,* Gould, Arnold, p. 182.

Genus, **Panomya,** Gray

298. *P. ampla,* Dall, U. S. N. M. XXIV, p. 560. Arnold, p. 183.

Sub-order, **SOLENACEA**

Family, SOLENIDAE

Genus, **Siliqua,** Muhlfeldt

299. *S. lucida,* Conrad, U. S. N. M. XXII, p. 109.

300. *S. media,* Gray, U. S. N. M. XXII, p. 109.

301. *S. patula,* Dixon, U. S. N. M. XXII, p. 109.

302. var. *alta,* Broderip & Sowerby.

303. var. *nuttallii,* Conrad.

Genus, **Solen,** Linne

304. *S. rosaceus,* Cpr., U. S. N. M. XXII, p. 108.

305. *S. sicarius,* Gould, U. S. N. M. XXII, p. 108.

Genus, **Ensis,** Schumacher

306. *E. californicus,* Dall, U. S. N. M. XXII, p. 108.

Sub-order, **MACTRACEA**

Family, MACTRIDAE

Genus, **Mactra,** Linné

307. *M. californica,* Conr., Nautilus VIII, p. 40. Arnold, p. 174.
308. *M. nasuta,* Gould, Nautilus VIII, p. 39.
309. *M. falcata,* Gould, Nautilus X, p. 19.
310. *M. dolabriformis,* Conrad, Nautilus VII, p. 138.

Genus, **Spisula,** Gray

311. *S. catilliformis,* Conr., Nautilus VII, p. 137; VIII, p. 40.
312. *S. falcata,* Gould, Nautilus X, p. 19. Arnold, p. 176.
313. *S. hemphillii,* Dall, Nautilus VII, p. 137; VIII, p. 40.
314. *S. planulata,* Conr., Nautilus VIII, p. 40.
315. *S. polymyma,* var. *alaskana,* Dall, Nautilus VIII, p. 40.

Genus, **Labiosa,** Schmidt

316. *L. undulata,* Gould, Nautilus VIII, p. 41.

Genus, **Tresus,** Gray

317. *T. nuttallii,* Conrad, Nautilus VIII, p. 42.

Order, **ANOMALODESMACEA**

Sub-order, **ANATINACEA**

Family, ANATINIDAE

Genus, **Thracia,** Leach

318. *T. curta,* Conr., described in this book.
319. *T. undulata,* Conrad, described in this book.
320. *T. beringi,* Dall, B. C. Bull. 1, p. 44.

Genus, **Periploma,** Schumacher

321. *P. discus,* U. S. N. M. XIII, p. 222.
322. *P. planiscula,* Sby., U. S. N. M. XIII, p. 224.

323. *P. sulcata,* Dall, Nautilus XVII, p. 122.

Family, LYONSIDAE

Genus, **Lyonsia,** Turton

324. *L. californica,* U. S. N. M. VIII, p. 546.

Genus, **Lionsiella,** M. Sars

325. *L. alaskana,* Dall, U. S. N. M. XVII, p. 703.

Genus, **Mytilimeria,** Conrad

326. *M. nuttallii,* Conrad, Arnold, p. 126.

Genus, **Entodesma,** Philippi

327. *E. inflata,* Conrad, described in this book.

328. *E. saxicola,* Baird, described in this book.

Family, VERTICORDIIDAE

Genus, **Verticordia,** S. Wood

329. *V. novemcostata,* Adams & Reeve, Arnold, p. 126.

330. *V. ornata,* Dall & Bartsch, San Pedro, teste Oldroyd.

Family, PANDORIDAE

Genus, **Clidiophora,** Carpenter

331. *C. punctata,* Cpr., U. S. N. M. XV, p. 183.

Genus, **Kennerlia,** Carpenter

332. *K. filosa,* Cpr., Arnold, p. 124.

333. *K. grandis,* Dall, B. C. Bull. 1, p. 44.

334. *K. bicarinata,* Cpr., Arnold, p. 123.

Sub-order, **ADESMACEA**

Family, PHOLADIDAE

Genus, **Pholas,** Linne

335. *P. pacifica,* Stearns, Pro. Cal. Acad. Sci., Apr. 7, 1873.

Genus, **Pholadidea,** Turton

336. *P. darwinii,* Sowerby, described in this book.
337. *P. parva,* Tryon, Nautilus V, p. 55; U. S. N. M. XV, p. 182.
338. *P. ovoidea,* Gould, described in this book.

Genus, **Penitella,** Conrad

339. *P. penita,* Conrad, Arnold, p. 184.

Genus, **Zirphaea,** Leach

340. *Z. crispata,* Linne, U. S. N. M. XV, p. 182.

Genus, **Parapholas,** Conrad

341. *P. californica,* Conrad, Figure 92.

Genus, **Martesia,** Leach

342. *M. intercalata,* Cpr., U. S. N. M. VIII, p. 545.

Family, TERIDIDAE

Genus, **Xylotrya,** Leach

343. *X. setacea,* Tryon, Nautilus V, p. 55.
344. *X. stutchburryi,* Jeffrey, described in this book.
345. *X. fimbriata,* Jeffrey, B. C. Bull. 1, p. 41.
346. *X. bipinnata,* Jeffrey, B. C. Bull. 1, p. 42.

Class, SCAPHOPODA

Order, **SOLENOCONCHIA**

Family, DENTALIIDAE

Genus, **Dentalium,** Linne

347. *D. pretiosum,* Nuttall, Nautilus X, p. 18.
348. *D. neohexagonum,* Pilsbry, Nautilus XVII, p. 108.
349. *D. semistriatum* var. *semipolitum,* Br. & Sby., Nautilus XIII, p. 28.
350. *D. rectius,* Cpr., B. C. Bull. 1, p. 54.

351. *D. vallicolens,* Raymond, Nautilus XVII, p. 123.
352. *D. watsoni,* S. & P., Tryon, Man. Conch.
353. *D. dalli,* S. & P., Tryon, Man. Conch.

Genus, **Cadulus,** Philippi

354. *C. nitentior,* Cpr., Nautilus XVII, p. 108.
355. *C. fusiformis,* Pilsbry & Sharp, Nautilus IX, p. 72; XIII, p. 28.
356. *C. aberrans,* Whiteaves, Nautilus IV, p. 36; IX, p. 72.
357. *C. quadrifissatus,* Cpr., Nautilus XIII, p. 29.
358. *C. hepburni,* Dall, B. C. Bull. 2, p. 12.
359. *C. tolmiei,* Dall, B. C. Bull. 2, p. 13.
360. *C. californicus,* Pilsbry & Sharp, Man. Conch.

Class, GASTEROPODA
Sub-class, ANISOPLEURA
Order, **PTEROPODA**
Family, CAVOLINIIDAE
Genus, **Cavolina,** Abildgaard

361. *C. tridentata,* Forsk, U. S. N. M. XV, p. 194.
362. *C. pacifica,* Dall, Nautilus XVIII, p. 19.

Genus, **Cleodora,** Péron & Lesueur

363. *C. pyramidata,* Péron, dredged off Catalina Island, teste Oldroyd.

Genus, **Corolla,** Dall

364. *C. spectabilis,* Dall, U. S. N. M. XV, p. 194.

Family, PNEUMODERMATIDAE
Genus, **Pneumodermon,** Cuvier

365. *P. pacificum,* Dall, U. S. N. M. XV, p. 194.

Order, **OPISTHOBRANCHIATA**

Sub-order, **TECTIBRANCHIATA**

Family, ACTAEONIDAE

Genus, **Actaeon,** Montfort

366. *A. punctocaelatus,* Cpr., Nautilus VII, p. 102; Arnold, p. 189.
367. *A. breviculus,* Dall, U. S. N. M. XXIV, p. 512.
368. *A. painei,* Dall, Nautilus XVIII, p. 19.
369. *A. traskii,* Stearns, Arnold, p. 188.

Family, TORNATINIDAE

Genus, **Tornatina,** A. Adams

370. *T. carinata,* Cpr., U. S. N. M. XV, p. 195.
371. *T. cerealis,* Gould, Arnold, p. 189.
372. *T. culcitella,* Gould, Nautilus XIII, p. 29.
373. *T. harpa,* Dall, Nautilus X, p. 19.
374. *T. inculta,* Gould, Nautilus XIII, p. 29.
375. *T. eximea,* Baird, Arnold, p. 190.

Genus, **Volvula,** A. Adams

376. *V. cylindrica,* Cpr., U. S. N. M. XV, p. 191; Arnold, p. 191.

Family, SCAPHANDRIDAE

Genus, **Diaphana,** Brown

377. *D. debilis,* Gould, B. C. Bull. 1, p. 54.

Genus, **Cylichna,** Lovén

378. *C. alba,* Brown, Arnold, p. 192.
379. *C. attonsa,* Cpr., B. C. Bull. 1, p. 54; Nautilus XIII, p. 28.
380. *C. planata,* Cpr., Man. Conch. XV, p. 302.
381. *C. propinqua,* Smith, Man. Conch. XV, p. 303.

Genus, **Utriculus,** Brown

382. *U. incultus,* Gould, Nautilus VII, p. 102.
Genus, **Bulla,** Linne

383. *B. gouldiana,* Pilsbry, U. S. N. M. XIX, p. 377.

384. *B. punctulata,* A. Adams, Arnold, p. 193.

385. *B. quoyi,* Gray, Arnold, p. 193.
Genus, **Haminea,** Leach

386. *H. vesicula,* Figure 98.

387. *H. virescens,* Sowerby, Nautilus VIII, p. 100.

388. *H. hydatis,* Linne, B. C. Bull. 1, p. 54.
Family, UMBRACULIDAE
Genus, **Tylodina,** Rafinesque

389. *T. fungina,* Gabb, U. S. N. M. XV, p. 195.
Family, APLYSIIDAE
Genus, **Aplysia,** Linne

390. *A. californica,* J. G. Cooper, Pro. Cal. Acad. Sci., Aug. 17, 1863.
Genus, **Navarchus,**

391. *N. inermis,* J. G. Cooper, Pro. Cal. Acad. Sci.
Family, PLEUROBRANCHIDAE
Genus, **Pleurobranchus,** Cuvier

392. *P. californicus,* Dall, Nautilus XIV, p. 92.
Order, **PULMONATA**
Sub-order, **STYLOMMATROPHORA**
Family, SELENITIDAE
Genus, **Selenites,** Fischer

393. *S. caelata,* Mazyck, U. S. N. M. IX, p. 460.

394. *S. duranti,* Newc., Nautilus XIV, p. 124.

395. var. *catalinensis,* Hmpl., Nautilus XIV, p. 124.

396. *S. vancouverensis,* Lea, Nautilus V, p. 91.
397. var. *keepi,* Hemphill, Nautilus IV, p. 42.
398. var. *hybrida,* Hemphill, Nautilus IV, p. 43.
399. *S. hemphilli,* W. G. Binney, Nautilus XIV, p. 72.
400. *S. sportella,* Gould, Nautilus V, p. 91.
401. var. *hybrida,* Ancey, Nautilus IX, p. 101.
402. *S. voyana,* Newcombe, Figure 100.
403. var. *simplicilabris,* Ancey, Pro. Acad. Sci., Phila., 1889, p. 196.

Family, LIMACIDAE

Genus, **Limax,** Linne

404. *L. campestris,* Binney, U. S. N. M. XIX, p. 366.
405. var. *occidentalis,* Cooper, Nautilus V, p. 56.
406. var. *zonatipes,* Ckll., Nautilus V, p. 56.
407. *L. (Amalia)hewstoni,* Cooper, Nautilus III, p. 105.
408. *L. montanus,* Ingersoll, Nautilus XV, p. 129.
409. *L. agrestis,* Linne, Nautilus V, pp. 91. 92 and 101.
410. *L. maximus,* Linne, Nautilus XVI, p. 133; XVIII, p. 23.
411. *L. hyperboreus,* Westerlund, Nautilus V, p. 91.
412. *L. hemphilli,* W. G. Binney, Nautilus IV, p. 24.
413. *L. flavus,* Linne, Nautilus XVI, p. 133.

Genus, **Agriolmax,**

414. *A. ashmuni,* Pils. & Van, Nautilus XIII, p. 17.

Genus, **Vitrina,** Draparnaud

415. *V. pfeifferi,* Newcomb, Nautilus V, p. 91; XIII, p. 64.

416. *V. exilis,* Morel, Nautilus XII, p. 109.

Genus, **Zonites,** Montfort

417. *Z. cellarius,* Muller, Nautilus V, p. 56.

418. *Z. whitneyi,* Newc., Pro. Phila. Acad., 1889, p. 197.

419. *Z. limatulus,* Ward,

420. *Z. minusculus,* Binney, Nautilus XIV, p. 85.

421. *Z. milium,* Morse,

422. *Z. chersinellus,* Dall, p. 198.

423. *Z. selenitoides,* Pilsbry, Nautilus III, p. 95.

424. *Z. fulvus,* Draparnaud,

425. *Z draparnaldi,* Beck, Science N. S., Vol. XI, No. 278.

426. *Z. lucidus,* Drap., Nautilus IX, p. 101.

427. *Z. johnsonii,* Dall, Nautilus IX, p. 101.

428. *Z. shepardi,* Hemphill, Nautilus V, p. 132.

429. *Z. diegoensis,* Hemphill, Nautilus V, p. 132.

Genus, **Zonitoides,** Lehm.

430. *Z. arboreus,* Say, Nautilus XIII, p. 36.

431. *Z. pugetensis,* Dall, U. S. N. M. XXIV, p. 500; Nautilus VIII, p. 130.

432. *Z. randolphi,* Pilsbry, Nautilus XII, pp. 87 and 110.

433. *Z. neomexicanus,* Ckll. & Pils., Nautilus XIII, p. 114.

Genus, **Pristiloma,** Ancey

434. *P. lansingi,* Bland, Nautilus V, p. 92; IX, p. 101.

435. *P. stearnsi,* Bland, Nautilus IX, p. 102.
436. *P. pilsbryi,* Vannetta, Nautilus XIII, p. 36.
437. *P. taylori,* Pilsbry,
438. *P. arctica,* Lehnert,

Family, HELICIDAE

Genus, **Ariolimax,** Morch

439. *A. columbianus,* Gould, Nautilus XI, p. 76.
440. *A. californicus,* Cooper, Nautilus XI, p. 76.
441. *A. niger,* J. G .Cooper, Pro. Phila. Acad. Sci., 1889, p. 199.
442. *A. hemphilli,* W. G. Binney,
443. *A. andersoni,* W. G. Binney,
444. *A. hecoxi,* Wetherby,
445. *A. columbianus* var. *stramineus,* Hemph., Nautilus IV, p. 120.
446. *A. steindachneri,* Babor, Nautilus XIV, p. 71.

Genus, **Aphallarion,** P. & V.

447. *A. buttoni,* P. & V., Pro. Phila. Acad. Sci., 1896, pp. 339-350.

Genus, **Arion,** Férussac

448. *A. foliolatus,* Gould, Nautilus III, p. 126; III, p. 105.
449. *A.* var. *hemphilli,* W. G. Binney, Nautilus III, p. 126.

Genus, **Anadenus,** Heynemann

450. *A. cockerelli,* Hemphill, Nautilus IV, p. 2.

Genus, **Hemphillia,** Bland & Binney

451. *H. glandulosa,* Bl. & Bin., Pro. Phila, Acad. Sci., 1889, p. 199.

452. *H. camelus,* Pils. & Van., Nautilus XI, p. 44.

Genus, **Binneya,** J. G. Cooper

453. *B. notabilis,* J. G. C., Pro. Phila. Acad. Sci., 1889, p. 199.

Genus, **Patula,** Held

454. *P. solitaria,* Say, Pro. Phila. Acad. Sci., 1889, p. 199.

455. *P. pauper,* Gould, Nautilus XII, p. 24.

456. *P. hornii,* Gabb, Pro. Phila. Acad. Sci., 1889, p. 200.

457. *P. ingersolli,* Bland, Pro. Phila. Acad. Sci., 1889, p. 200.

458. *P. lineata,* Say, Pro. Phila. Acad. Sci., 1889, p. 200.

459. *P. (Acanthinula) harpa,* Say, U. S. N. M. IX, p. 219.

Genus, **Punctum,** Morse

460. *P. conspectum,* Nautilus XI, p. 133; XVI, p. 133.

461. var. *pasadenae,* Pilsbry, Nautilus X, p. 21.

462. *P. pygmaeum,* Drap., Nautilus XVI, p. 58.

463. *P. clappi,* Pilsbry, Nautilus XI, p. 133.

464. *P. californicum,* Pilsbry, Nautilus XI, p. 134.

465. *P. minutissimum,* Lea, Nautilus V, p. 92.

Genus, **Helix,** Linne

466. *H. aspersa,* Müll, Nautilus XV, p. 119.

Genus, **Epiphragmophora,** Döring

467. *E. fidelis,* Gray, Nautilus XIII, p. 25.

468. *E. infumata,* Gould, Nautilus XIII, p. 26.

469. *E. arrosa,* Gould, Pro. Phila. Acad. Sci., 1889, p. 201.

470. var. *expansilabris,* Pilsbry, Nautilus XII, p. 22.
471. *E. californiensis,* Lea, Pro. Phila. Acad. Sci., 1889, p. 201.
472. var. *contracostæ,* Pilsbry, Nautilus IX, p. 72; XI, p. 54.
473. var. *nickliniana,* Lea, Pro. Phila. Acad. Sci., 1889, p. 201.
474. var. *anachoreta,* W. G. Binney, Pro. Phila. Acad. Sci., 1889, p. 201.
475. var. *ramentosa,* Gld., Pro. Phila. Acad. Sci., 1889, p. 201.
476. var. *bridgesi,* Newcomb, Pro. Phila. Acad. Sci., 1889, p. 201.
477. var. *diabloensis,* J. G. Cooper, Pro. Phila. Acad. Sci., 1889, p. 201.
478. *E. exarata,* Pfr., Pro. Phila. Acad. Sci., 1889, p. 201.
479. var. *rubicunda,* Rowell, Nautilus XVI, p. 52.
480. *E. tudiculata,* Binney, Pro. Phila. Acad. Sci., 1889, p. 201.
481. var. *binneyi,* Hemphill, Nautilus IV, p. 24.
482. var. *subdola,* Hemphill, Nautilus IV, p. 41.
483. var. *umbilicata,* Pilsbry, Nautilus XII, p. 22.
484. *E. dupetithouarsi,* Deshayes, Pro. Phila. Acad. Sci., 1889, p. 201.
485. *E. sequoicola,* Cooper, Pro. Phila. Acad. Sci., 1889, p. 201.
486. *E. traski,* Newcomb, Nautilus XIV, p. 13.
487. *E. mormonum,* Pfeiffer, Nautilus XIII, p. 128.

488. var. *cala,* Pilsbry, Nautilus XIII, p. 128.
489. var. *buttoni,* Pilsbry, Nautilus XIII, p. 128.
490. var. *hillebrandi,* Newcomb, Nautilus XIII, p. 128.
491. var. *circumcarinata,* Stearns, Pro. Phila. Acad. Sci., 1889, p. 201.
492. *E. carpenteri,* Newcomb, Nautilus IV, p. 51.
493. var. *indioensis,* Yates, Nautilus IV, p. 63.
494. *E. rowelli,* Newcomb, Pro. Phila. Acad. Sci., 1889, p. 202.
495. *E. ruficincta,* Newcomb, Nautilus XIV, p 124.
496. var. *feralis,* Hemphill, Nautilus XIV, p. 124.
497. var. *gabbi,* Newcomb, Nautilus XIV, p. 124.
498. var. *facta,* Newcomb, Nautilus XIV, p. 124.
499. var. *catalinae,* Dall, Nautilus XIV, p. 124.
500. var. *sodalis,* Hemphill, Nautilus XIV, p. 124.
501. *E. kellettii,* Forbes, Nautilus XIV, p. 124.
502. var. *castanea,* Hemphill, Nautilus XIV, p. 124.
503. var. *nitida,* Hemphill, Nautilus XIV, p. 124.
504. var. *multilineata,* Hemphill, Nautilus XIV, p. 124.
505. var. *frater,* Hemphill, Nautilus XIV, p. 124.
506. var. *californica,* Hemphill, Nautilus XIV, p. 124.

507. var. *forbesii,* Hemphill, Nautilus XIV, p. 124.
508. var. *bicolor,* Hemphill, Nautilus XIV, p. 124.
509. var. *redimita,* W. G. Binney, Nautilus XIV, p. 124.
510. var. *hybrida,* Hemphill, Nautilus XIV, p. 124.
511. var. *castanea,* Hemphill, Nautilus XIV, p. 124.
512. var. *clementinae,* Dall, Nautilus XIV, p. 124.
513. *E. ayresiana,* Newcomb, Nautilus XIV, p. 124.
514. *E. stearnsiana,* Gabb, Pro. Phila. Acad. Sci., 1889, p. 202.
515. *E. intercisa,* W. G. Binney, Nautilus XIV, p. 124.
516. var. *minor,* Hemphill.
517. var. *elegans,* Hemphill.
518. var. *nepos,* Hemphill.
519. var. *albida,* Hemphill.
520. *E. tryonii,* Newcomb, Nautilus XIV, p. 124.
521. var. *varia,* Hemphill.
522. var. *nebulosa,* Hemphill.
523. var. *fasciata,* Hemphill.
524. var. *californica,* Hemphill.
525. var. *albida,* Hemphill.
526. var. *maculata,* Hemphill.
527. var. *major,* Hemphill.
528. var. *minor,* Hemphill.
529. *E. bowersi,* Bryant, Nautilus XIII, p. 122.

530. *E. coloradoensis,* Stearns, U. S. N. M. XIX, p. 340.
531. *E. harperi,* Bryant, Nautilus XIII, p. 143.
532. *E. arizonensis,* Dall, U. S. N. M. XIX, p. 337.
533. *E. magdalenensis,* Stearns, U. S. N. M. XIX, p. 339.
534. *E. arnheimi,* Dall, U. S. N. M. XIX, p. 375.

Genus, **Glyptostoma,** Binney & Bland

535. *G. newberryanum,* W. G. Binney, U. S. N. M. XIX, p. 376.
536. var. *depressum,* Bryant, Nautilus XVI, p. 70.

Genus, **Polygyra,** Say

537. *P. armigera,* Ancey, Nautilus V, p. 56.
538. *P. columbiana,* Lea, Nautilus XII, p. 109.
539. var. *labiosa,* Gould, Man. Conch. III, p. 154.
540. *P. devia,* Gould, Nautilus IX, p. 102.
541. var. *hemphilli,* W. G. Binney, Nautilus XV, p. 129.
542. var. *clappi,* Hemphill, Nautilus XI, p. 74.
543. *P. mearnsii,* Dall, U. S. N. M. XIX, p. 343.
544. *P. roperi,* Pilsbry, Nautilus III, p. 14; XII, p. 59.
545. *P. loricata,* Gould, Nautilus XIII, p. 64.
546. *P. tridontoides,* Bland, Nautilus XIII, p. 84.
547. *P. mullani,* Bland & Cooper, Man. Conch. III, p. 145.
548. var. *olneyae,* Pilsbry, Nautilus V, p. 47.
549. *P. townsendiana,* Lea, Nautilus XII, p. 24.
550. var. *ptychophora,* A. D. Brown, Nautilus XV, p. 129.

551. *P. chiricahuana,* Dall, U. S. N. M. XIX, p. 341.

Genus, **Polygyrella,** Bland

552. *P. harfordiana,* Cooper, Nautilus V, p. 40.
553. *P. polygyrella,* Bland, Nautilus V, p. 42.
554. *P. yatesi,* Cooper, Man. Conch. III, p. 115.

Genus, **Stenotrema,** Rafinesque

555. *S. germanum,* Gld., Nautilus V, p. 92; IX, p. 102.
556. *S. hirsutum,* Say, Nautilus III, p. 81.

Genus, **Thysanophora,** Strebel & Pfeiffer

557. *S. hornii,* Gabb, Nautilus XIII, p. 98.
558. *S. ingersollii,* Bland, Nautilus XIV, p. 85.

Genus, **Vallonia,** Risso

559. *V. cyclophorella,* Ancey, Nautilus XIV, p. 85.
560. *V. gracilicosta,* Reinhart, U. S. N. M. XIX, p. 366.
561. *V. costata,* Müller, U. S. N. M. XIX, p. 366.
562. *V. pulchella,* Müller, Nautilus XII, p. 71; XIV, p. 65.

Genus, **Ashmunella,** Pilsbry

563. *A. rhyssa,* Dall, Nautilus XI, p. 2; U. S. N. M. XXIV, p. 500.
564. var. *hyporhyssa,* Ckll., Nautilus XIV, p. 72; XVI, p. 58.
565. *A. pseudodonta,* Dall, U. S. N. M. XXIV, p. 500.
566. var. *capitanensis,* Ash & Ckll., Nautilus XII, p. 131.
567. *A. ashmuni,* Dall, U. S. N. M. XXIV, p. 501; XIX, p. 342.

568. *A. levettei,* Bland, Nautilus XVI, p. 59.
569. *A. thomsoniana,* Ancey, Nautilus XV, p. 109.
570. var. *porterae,* Pils. & Ckll., Nautilus XII, p. 49.
571. var. *cooperae,* Cockerell, Nautilus XV, p. 35; XVII, p. 36.

Genus, **Sonorella,** Pilsbry

572. *S. hachitana,* Dall, Pro. Phila. Acad. Sci., 1900, p. 557.
573. *S. rowelli,* Pilsbry, Pro. Phila. Acad. Sci., 1902, p. 511.
574. *S. granulatissima,* Pilsbry, Pro. Phila. Acad. Sci., 1902, p. 511.
575. *S. walcottiana,* Bartsch, Nautilus XVII, p. 72.

Genus, **Vitrea,** Fitz

576. *V. johnsoni,* Dall, Nautilus IX, p. 27.
577. *V. hammonis,* Ström, Nautilus XIII, p. 64.
578. *V. pugetensis,* Dall, Nautilus IX, p. 27.
579. *V. indentata,* Say, Pro. Phila. Acad. Sci., 1902, p. 511.
580. var. *umbilicata,* Ckll., Nautilus XVI, p. 58.
581. *V. subrupicola,* Dall, U. S. N. M. XIX, p. 366.

Genus, **Oreohelix,** Pilsbry

582. *O. cronkhitei,* Newcomb, U. S. N. M. XIX, p. 366; Nautilus XVII, p. 131.
583. *O. striatella,* Anthony, Nautilus XIII, p. 64.
584. *O. elrodi,* Pilsbry, Nautilus XVI, p. 62; XVI, p. 111.
585. *O. cockerelli,* Pils., Nautilus XII, p. 85.

586. mut. *viridula,* Ckll., Nautilus XIV, p. 85.
587. *O. strigosa,* Gould, Nautilus XVII, p. 1.
588. var. *alpina,* Elrod, Nautilus XVII, p. 2.
589. var. *cooperi,* W. G. Binney, Nautilus XVII, p. 4.
590. var. *utahensis,* Hempl., Pro. Phila. Acad. Sci., 1889, p. 199.
591. var. *haydeni,* Gabb, Pro. Phila. Acad. Sci., 1889, p. 200.
592. *O. idahoensis,* Newcomb, Pro. Phila. Acad. Sci., 1889, p. 200.

Genus, **Bulimus,** Fer.

593. *B. ventrosus,* Fer., "Science" N. S. XI, p. 657.

Genus, **Cochlicopa,** Fer.

594. *C. lubrica,* Müller, Nautilus V, p. 92; XIII, p. 12.

Genus, **Euconulus,** Pilsbry (Fitz)

595. *E. fulvus,* Müller, Nautilus XII, p. 115.
596. var. *alaskensis,* Pilsbry, Nautilus V, p. 92; XVI, p. 116.

Genus, **Helicodiscus,** Morse

597. *H. lineatus,* Say, Nautilus XIV, p. 85.
598. *H. fimbriatus,* var. *salmonensis,* Hempl., Nautilus IV, p. 85.

Family, PUPIDAE

Genus, **Pupa,** Draparnaud

599. *P. fallax,* Say, Nautilus VI, p. 4.
600. *P. muscorum,* Linne, U. S. N. M. XIX, p. 367.
601. var. *blandi,* Morse, U. S. N. M. XIX, p. 367.

602. *P. syngenes,* Pilsbry, Nautilus V, p. 39; VI, p. 4; IV, p. 3.
603. *P. gabbii,* Dall, Pro. Phila. Acad. Sci., 1889, p. 206.
604. *P. hordeacea,* Gabb, Nautilus VI, p. 4.
605. *P. pilsbryana,* Sterki, Nautilus VI. p. 4; XIII, p. 16; XIV, p. 85.
606. *P. decora,* Gould, Nautilus XII, pp. 109 and 111.
607. *P. corpulenta,* Morse, Nautilus V, p. 92.
608. *P. procera,* Gould, U. S. N. M. XIX, p. 367; Nautilus XIV, p. 86.
609. *P. rowellii,* Newcomb, Pro. Phila. Acad. Sci., 1889, p. 206; Nautilus VI, p. 5.
610. *P. californica,* Rowell, Nautilus IV, p. 8; IV, p. 18; XIV, p. 124.
611. *P. calamitosa,* Pilsbry, Nautilus III, p. 61; VI, p. 5.
612. *P. edentula,* var. *alticola,* Ing., Pro. Phila. Acad. Sci., 1889, p. 207.
613. *P. sterkiana,* Pilsbry, Nautilus VI, p. 4.
614. *P. arizonensis,* Gabb, Nautilus III, p. 118.
615. *P. clementina,* Sterki, Nautilus IV, p. 44; XIV, p. 124; VI, p. 5.
616. *P. dalliana,* Sterki, Nautilus IV, p. 19; XII, p. 91.
617. *P. holzingeri,* Sterki, Nautilus III, p. 119; XIV, p. 86.
618. *P. hemphilli,* Sterki, Nautilus IV, p. 27.
619. *P. blandi,* Morse, Nautilus XIV, p. 85.

Genus, **Pupilla,** Leach

620. *P. sonorana,* Sterki, Nautilus XIII, p. 16; XII, p. 128.
621. var. *tenella,* Sterki, Nautilus XIII, p. 16; XII, p. 129.

Genus, **Bifidaria,** Sterki

622. *B. ashmuni,* Sterki, Nautilus XII, p. 49; XIII, p. 16.
623. *B. perversa,* Sterki, Nautilus XII, p. 90.
624. *B. quadridentata,* Sterki, Nautilus XII, p. 128.
625. *B. pentadon,* Say, Nautilus XIII, p. 16.
626. *B. hordeacella,* Pilsbry, Nautilus XIV, p. 86.
627. var. *parvidens,* Sterki, Nautilus XII, p. 128.
628. *B. armifera,* Say, Nautilus VI, p. 4; XIV, p. 86.
629. var. *ruidosensis,* Ckll., Nautilus XIII, p. 36.

Genus, **Vertigo,** Müller

630. *V. ovata,* Say, Nautilus V, p. 92.
631. *V. ventricosa,* Morse, U. S. N. M. XIX, p. 367.
632. *V. tridentata,* Wolf, U. S. N. M. XIX, p. 367.
633. *V. simplex,* Gould, Nautilus V, p. 92; IX, p. 102.
634. *V. binneyana,* Sterki, Nautilus IX, p. 102.
635. *V. castanea,* Sterki, Nautilus VI, p. 5.
636. *V. borealis,* Mor., Nautilus VI, p. 5.
637. *V. columbiana,* Sterki, Nautilus VI, p. 5.
638. var. *utahensis,* Sterki, Nautilus VI, p. 5.
639. *V. concinnula,* Ckll., Nautilus XVI, p. 58.
640. *V. coloradoensis,* Ckll., Nautilus XVI, p. 58.

641. *V. ingersolli,* Ancey, Nautilus XVI, p. 59.

Genus, **Holospira,** Von Martens

642. *H. arizonensis,* Stearns, U. S. N. M. XIII, p. 208.

643. *H. roemeri,* Pfr., Nautilus XVI, p. 58.

Family, SUCCINIDAE

Genus, **Succinea,** Draparnaud

644. *S. avara,* Say, Nautilus XIV, p. 125.

645. var. *vermeta,* Say, Nautilus XIV, p. 125.

646. var. *guadalupensis,* Dall.

647. var. *oregonensis,* Lea.

648. var. *rusticana,* Gould.

649. *S. nuttalliana,* Lea, Nautilus IX, p. 102; XV, p. 129.

650. *S. sillimani,* Bland, Nautilus VI, p. 29.

651. *S. stretchiana,* Bland, Nautilus VI, pp. 31 and 72.

652. *S. chrysis,* Westerl, Nautilus IV, p. 23; XII, p. 110.

653. *S. hawkinsi,* Baird, Pro. Phila. Acad. Sci., 1889, p. 209.

654. *S. annexa,* Westerlund, Nautilus IV, p. 23.

655. *S. ovalis* var. *haydeni,* W. G. B., Pro. Phila. Acad. Sci., 1889, p. 209.

Family, VAGINULIDAE

Genus, **Vaginulus,** Ferussac

656. *V. olivaceus,* Stearns, Pro. Phila. Acad. Sci., 1889, p. 209.

Family, ONCHIDIIDAE

Genus, **Onchidella,** Gray

657. *O. borealis,* Dall, Nautilus V, p. 92.

658. *O carpenteri,* W. G. Binney, Nautilus V, p. 92.

Family, AURICULIDAE

Genus, **Alexia,** Leach

659. *A. myosotis,* Drap., described in this book.

Genus, **Carychium,** O. F. Muller

660. *C. exiguum,* Say, Nautilus V, p. 92.

661. var. *occidentale,* Pilsbry, Nautilus IV, p. 109; VIII, p. 63.

Genus, **Pedipes,** Blainville

662. P. *unisulcatus,* J. G. Cooper, U. S. N. M. XV, p. 196.

663. *P. liratus,* Binney, U. S. N. M. VIII, p. 545.

Genus, **Melampus,** Montfort

664. *M. olivaceus,* Cpr., U. S. N. M. XIX, p. 376.

Family, SIPHONARIIDAE

Genus, **Siphonaria,** Sowerby

665. *S. thersites,* Carpenter, U. S. N. M. VIII, p. 210.

666. *S. (Williamia) peltoides,* Cpr., U. S. N. M. XV, p. 196; Nautilus, XVIII, p. 20.

Genus, **Gadinia,** Gray

667. *G. reticulata,* Sby., U. S. N. M. XV, p. 196.

668. *G. stellata,* Sby., San Pedro Bay, teste Williamson. Cpr. Report, p. 31.

Family, LIMNAEIDAE

Genus, **Limnaea,** Lamarck

669. *L. stagnalis,* Linne, Nautilus XIII, p. 64.

670. var. *occidentalis,* Hempl., Nautilus IV, p. 26.

671. var. *appressa,* Say, Nautilus XV, p. 111.

672. *L. palustris,* Muller, Nautilus V, p. 56; XII, p. 110.
673. var. *proxima,* Lea, Nautilus V, p. 56.
674. var. *nuttilliana,* Lea, Nautilus XVII, p. 84.
675. var. *rowellii,* Tryon, Nautilus V, p. 56.
676. var. *umbrosa,* Say, Nautilus V, p. 56.
677. var. *traskii,* Tryon, Nautilus V, p. 56.
678. *L. lepida,* Gould, U. S. N. M. XIV, p. 102.
679. *L. adelinae,* Tryon, U. S. N. M. XIV, p. 102.
680. *L. tryoni,* Lea, Nautilus IX, p. 102.
681. *L. bombycina,* Lunge, Nautilus V, p. 56.
682. *L. humilis,* Say, Nautilus XIII, p. 65.
683. var. *ferruginea,* Hald, Nautilus V, p. 56.
684. *L. emarginata,* var. *montana,* Elrod, Nautilus XV, p. 111.
685. *L. kirtlandiana,* Lea, Figure 130.
686. *L. obrussa,* Say, Nautilus V, p. 56.
687. *L. pilsbryi,* Hemphill, Nautilus IV, p. 25.

Genus, **Radix,** Montfort

688. *R. ampla,* var. *utahensis,* Call, Bull. U. S. Geol. Sur. XI, p. 47.

Genus, **Limnophysa,** Fitz

689. *L. bulimoides,* Lea, Bull. U. S. Geol. Sur. XI, p. 18.
690. *L. caperata,* Say, Figure 129.
691. *L. catascopium,* Say, S. I. Mis. Coll. No. 143, p. 53.

Genus, **Physa,** Draparnaud

692. *P. heterostropha,* Say, Nautilus VI, p. 20; XV, p. 112.
693. *P. mexicana,* Phil., U. S. N. M. XIX, p. 368.

694. *P. carltonii,* Lea, West Coast Shells, p. 119.
695. *P. cooperi,* Tryon, West Coast Shells, p. 119.
696. *P. costata,* Newc., S. I. Mis. Coll. No. 143, p. 91.
697. *P. gabbi,* Tryon, Nautilus IX, p. 102.
698. var. *orbignyana,* Lea, Nautilus V, p. 56.
699. var. *traskii,* Lea, Nautilus V, p. 56.
700. *P. politissima,* Tryon, West Coast Shells, p. 119.
701. *P. humerosa,* Gould, S. I. Mis. Coll. No. 143, p. 92.
702. *P. triticea,* Lea, Nautilus III, p. 49; XVII, p. 84.
703. *P. diaphana,* Tryon, Nautilus V, p. 56.
704. *P. virginea,* Gould, Nautilus V, p. 56.
705. *P. ampullacea,* Gld., Nautilus XV, p. 112.
706. var. *columbiana,* Hempl., Nautilus IV, p. 27.
707. *P. gyrina,* Say, Nautilus XV, p. 112.

Genus, **Physella,** Pfeiffer

708. *P. columbiana,* Hempl., West Coast Shells, p. 120.

Genus, **Aplexa,** Fleming

709. *A. hypnorum,* Linne, Figure 132.
710. var. *tryoni,* Currier, Nautilus XV, p. 112.

Genus, **Pompholyx,** Lea

711. *P. effusa,* Lea, Nautilus XII, p. 60; XIII, p. 65.

Genus, **Carinifex,** Binney

712. *C. newberryi,* Lea, Nautilus XIII, p. 65.

Genus, **Planorbis,** Guettard

713. *P. trivolvis,* Say, U. S. N. M. XIV, p. 102.
714. var. *horni,* Tryon, Nautilus XIII, p. 65; XVII, p. 84.
715. var. *binneyi,* Tryon, Nautilus IX, p. 102.
716. *P. tumens,* Cpr., U. S. N. M. XIV, p. 102.
717. *P. parvus,* Say, Nautilus XIII, p. 65; XVII, p. 84.
718. *P. liebmannii,* Dunker, U. S. N. M. XIX, p. 369.
719. *P. tumidus,* Pfeiffer, U. S. N. M. XIX, p. 369.
720. *P. subcrenatus,* Cpr., S. I. Mis. Coll. 143, p. 103.
721. *P. vermicularis,* Gould, Nautilus IX, p. 102; Arnold, p. 195.
722. var. *disjectus,* J. G. Cooper, Nautilus IV, p. 131.
723. *P. centervillensis,* Tryon, Nautilus IX, p. 36.
724. *P. callioglyptus,* Vanetta, Nautilus IX, p. 102; IX, p. 54.
725. *P. ammon,* Gould, Nautilus V, p. 56; XIII, p. 137.
726. *P. opercularis,* Gould, Nautilus V, p. 56.
727. var. *multilineatus,* Van., Nautilus XIII, p. 48.

Genus, **Helisoma,** Swainson

728. *H. bicarinatus,* Say, S. I. Miss. Coll. 143, p. 123.

Genus, **Ancylus,** Geoff

729. *A. fragilis,* Tryon, Nautilus V, p. 56; IX, p. 102.

730. *A. subrotundus,* Tryon, West Coast Shells, p. 115.

731. *A. oregonensis,* Clessin, Nautilus XIII, p. 65; XII, p. 60.

732. *A. caurinus,* Cpr., Nautilus V, p. 120.
Genus, **Lanx,** Clessin

733. *L. patelloidea,* Lea, Nautilus XII, p. 60.

734. *L. altus,* Tryon, Nautilus XIII, p. 65.
Genus, **Acroloxus,** Beck

735. *A. nuttallii,* Haldeman, Figure 137.
Genus, **Gundlachia,**

736. *G. californica,* Pfeiffer, S. I. Mis. Coll. 143, p. 149.
Order, **CTENOBRANCHIATA**
Sub-order, **ORTHODONTA**
Family, TEREBRIDAE
Genus, **Terebra,** Adanson

737. *T. specillata,* Hinds, S. I. Miss. Coll. No. 252, p. 101.
Genus, **Myurella,** Hinds

738. *M. simplex,* Cpr., Nautilus VII, p. 133.
Family, CONIDAE
Genus, **Conus,** Linne

739. *C. californicus,* U. S. N. M. XV, p. 208.
Family, PLEUROTOMIDAE
Genus, **Pleurotoma,** Lamarck

740. *P. carpenteriana,* Gabb, U. S. N. M. XII, p. 303.

741. *P. perversa,* Gabb, U. S. N. M. XXIV, p. 513.

742. *P. tryoniana,* Gabb, Arnold, p. 203.
743. *P. tuberculata,* Gray, U. S. N. M. XV, p. 207.
744. *P. vinosa,* Dall, U. S. N. M. XXIV, p. 214.
745. *P. piona,* Dall, U. S. N. M. XXIV, p. 214.
746. *P. thalæa,* Dall, U. S. N. M. XXIV, p. 214.
747. *P. santarosana,* Dall, U. S. N. M. XXIV, p. 515.
748. *P. circinata,* Dall, U. S. N. M. XXIV, p. 515.
749. *P. beringi,* Aurivillius, U. S. N. M. VIII, p. 216.
750. *P. stearnsiana,* Raymond, Nautilus XVIII, p. 1.
751. *P. catalinae,* Raymond, Nautilus XVIII, p. 2.

Genus, **Cythara,** Schum.

752. *C. victoriana,* Bull. B. C. Nat. Hist. Soc., No. 2, p. 13.

Genus, **Daphnella,** Hinds

753. *D. clathrata,* Gould, Nautilus XVIII, p. 19.

Genus, **Drillia,** Gray

754. *D. empyrosia,* Dall, U. S. N. M. XXIV, p. 516; Nautilus, XII, p. 127.
755. *D. hemphilli,* Stearns, Nautilus VII, p. 133.
756. *D. incisa,* Cpr., Nautilus VII, p. 101.
757. *D. inermis,* Hds., Nautilus XIII, p. 28.
758. *D. moesta,* Cpr., S. I. Mis. Coll. No. 252, p. 143.
759. *D. penicillata,* Cpr., U. S. N. M. XV, p. 208.
760. *D. torosa,* Cpr., S. I. Mis. Coll. No. 252, p. 143.

761. *D. cancellata,* Nautilus VII, p. 101; Arnold, p. 204.
762. *D. montereyensis,* Stearns, Arnold, p. 207.
763. *D. pedroana,* Dall, Nautilus XIII, p. 28.
764. *D. pudica,* Hinds, Nautilus XIII, p. 28.
765. *D. quisqualis,* Hinds, Nautilus XIII, p. 28.

Genus, **Clathurella,** Carpenter

766. *C. affinis,* Dall, rare, fide Oldroyd.
767. *C. canfieldi,* very rare, fide Oldroyd.
768. *C. conradiana,* Gabb, Arnold, p. 210.
769. *C. lowei,* Dall, Pro. Biol. Soc. of Wash. XVI, p. 172.
770. *C. intricata,* Cpr., S. I. Mis. Coll. No. 272, p. 97.

Genus, **Bela,** Gray

771. *B. alaskensis,* Dall, U. S. N. M. IX, p. 299.
772. *B. albrechti,* Krause, U. S. N. M. IX, p. 300.
773. *B. harpa,* Dall, U. S. N. M. IX, p. 300.
774. *B. krausei,* Dall, U. S. N. M. IX, p. 301.
775. *B. solida,* Dall, U. S. N. M. IX, p. 301.
776. *B. lævigata,* Dall, U. S. N. M. IX, p. 300.
777. *B. sculpturata,* Dall, Nautilus VII, p. 101; Arnold, p. 214.
778. *B. fidicula,* Gould, Nautilus X, p. 18; Arnold, p. 209.
779. *B. tabulata,* Cpr., Bull. B. C. Nat. Hist. Soc. No. 1, p. 64.
780. *B. excurvata,* Cpr., Bull. B. C. Nat. Hist. Soc. No. 1, p. 64.
781. *B. violacea,* Migh. & Ad., Bull. B. C. Nat. Hist. Soc. No. 1, p. 65.

782. *B. trevelyana,* Turton, Bull. B. C. Nat. Hist. Soc. No. 1, p. 65.

783. *B. exarata,* Möller, Bull. B. C. Nat. Hist. Soc. No. 1, p. 65.

Genus, **Mangilia,** Risso

784. *M. angulata,* Cpr., Arnold, p. 212.

785. *M. densistriosa,* Cpr., rare, fide Oldroyd.

786. *M. fusconotata,* Cpr., very rare, fide Oldroyd.

787. *M. merita,* Gould, Figure 147.

778*a*. *M. neglecta,* Ad., S. I. No. 252, p. 36.

779*a*. *M. striosa,* C. B. Adams, Arnold, p. 215.

780*a*. *M. variegata,* Cpr., S. I. No. 252, p. 144.

781*a*. *M. leridensis,* Cpr., U. S. N. M. IX, p. 299.

782*a*. *M. aleutica,* Dall, U. S. N. M. IX, p. 299.

783*a*. *M. interlirata,* Stearns, Arnold, p. 213.

784*a*. *M. crebricostata,* Cpr., B. C. Bull. 1, p. 64.

785*a*. *M. interfossa,* Cpr., B. C. Bull. 1, p. 64.

786*a*. *M. fancherae,* Dall, Pro. Bio. Soc. of Wash. XVI, p. 172.

Family, CANCELLARIDAE

Genus, **Cancellaria,** Lamarck

787*a*. *C. cooperi,* Gabb, U. S. N. M. XV, p. 211.

788. *C. crawfordiana,* Dall, U. S. N. M. XIV, p. 182.

789. *C. middendorffiana,* Dall, U. S. N. M. IX, p. 297; XXIV, p. 516.

790. *C. modesta,* Cpr., Nautilus X, p. 18.

791. *C. circumcincta,* Dall, Nautilus VII, p. 101.

792. *C. unalaskensis,* Dall, Nautilus X, p. 18.

Genus, **Admete,** Kröyer

793. *A. gracilior,* Cpr., San Pedro, fide Oldroyd.
794. *A. arctica,* Midd, Man. Conch. VII, p. 85.
795. *A. tabulata,* Sowerby, Man. Conch. VII, p. 85.
796. *A. limnaeformis,* E. A. Smith, Man. Conch. VII, p. 85.
797. *A. viridula,* Fabr., Man. Conch. VII, p. 84.

Family, OLIVIDAE

Genus, **Olivella,** Swainson

798. *O. biplicata,* Sby., U. S. N. M. XV, p. 212.
799. *O. intorta,* Cpr., U. S. N. M. XXII, p. 140: XV, p. 212.
800. *O. pedroana,* Conr., Nautilus XIII, p. 129: Arnold, p. 221.

Family, MARGINELLIDAE

Genus, **Marginella,** Lamarck

801. *M. jewettii,* Cpr., U. S. N. M. XV, p. 212.
802. *M. pyriformis,* Cpr., U. S. N. M. XV, p. 212.
803. *M. regularis,* Cpr., U. S. N. M. XV, p. 212.
804. *M. subtrigona,* Cpr., S. I. Miss. Coll. No. 252, p. 147.
805. *M. varia,* Sby., Nautilus VII, p. 133; Arnold, p. 222.

Family, MITRIDAE

Genus, **Mitra,** Lamarck

806. *M. maura,* Swainson, S. I. Miss. Coll. No. 252, p. 147.
807. *M. lowei,* Dall, Pro. Bio. Soc. of Wash. XVI, p. 173.

Genus, **Mitromorpha,** Adams

808. *M. aspera,* Cpr., U. S. N. M. XV, p. 208.

809. *M. filosa,* Cpr., Arnold, p. 223.
810. *M. intermedia,* Arnold, Arnold, p. 223.
811. *M. effusa,* Cpr., Bull. B. C. Nat. Hist. Soc. No. 1, p. 65.

Family, FASCIOLARIIDAE

Genus, **Fusus,** Lamarck

812. *F. barbarensis,* Trask, U. S. N. M. XV, p. 217; Arnold, p. 224.
813. *F. kobelti,* Dall, U. S. N. M. XIV, p. 177.
814. *F. luteopictus,* Dall, U. S. N. M. XV, p. 217; Arnold, p. 225.
815. *F. harfordi,* Stearns, U. S. N. M. XIV, p. 178.
816. *F. roperi,* Dall, U. S. N. M. XXIV, p. 517; Nautilus XII, p. 4.
817. *F. robustus,* Trask, Arnold, p. 226.
818. *F. rugosus,* Trask, Arnold, p. 226.

Genus, **Metzgeria,** Norman

819. *M. californica,* Dall, Nautilus XVII, p. 52.

Family, BUCCINIDAE

Sub-family, NEPTUNINAE

Genus, **Chrysodomus,** Swainson

820. *C. amiantus,* Dall, U. S. N. M. XII, p. 321.
821. *C. dirus,* Rve, S. I. Miss. Coll. No. 252, p. 150.
822. *C. lyratus,* Martyn, Bull. B. C. Nat. Hist. Soc. No. 1, p. 71.
823. *C. tabulatus,* Baird, U. S. N. M. XXIV, p. 524.
824. *C. (Kellettia) kellettii,* Forbes, Arnold, p. 229.

825. *C. ithius,* Dall, U. S. N. M. XVII, p. 708; XIV, p. 187.
826. *C. periscelidus,* Dall, U. S. N. M. XVII, p. 708.
827. *C. phoeniceus,* Dall, U. S. N. M. XVII, p. 708.
828. *C. eucosmius,* Dall, U. S. N. M. XVII, p. 709.
829. *C. hypolispus,* Dall, U. S. N. M. XVII, p. 708.
830. *C. acosmius,* Dall, U. S. N. M. XVII, p. 708.
831. *C. halibrectus,* Dall, U. S. N. M. XIV, p. 188.
832. *C. insularis,* Dall, U. S. N. M. XVII, p. 707.
833. *C. magnus,* Dall, U. S. N. M. XVII, p. 709.
834. *C. griseus,* Dall, U. S. N. M. XII, p. 322.
835. *C. aphelus,* Dall, U. S. N. M. XII, p. 323.
836. *C. rectirostris,* Cpr., Nautilus X, p. 18; Arnold, p. 228.
837. *C. fornicatus,* Gmelin, Bull. B. C. Nat. Hist. Soc. No. 1, p. 71.
838. *C. kroyeri,* Moller, U. S. N. M. VIII, p. 215.

Genus, **Sipho,** Klein

839. *S. verkruzeni,* Kobelt, Nautilus X, p. 18.

Genus, **Mohnia,** Friele

840. *M. frielei,* Dall, U. S. N. M. XIV, p. 186; XVII, p. 712.

Sub-family, BUCCININAE

Genus, **Buccinum,** Linne

841. *B. aleuticum,* Dall, U. S. N. M. XVII, p. 706.
842. *B. angulosum,* Gray, U. S. N. M. XXIV, p. 517.
843. *B. taphrium,* Dall, U. S. N. M. XIV, p. 186.

844. *B. strigillatum,* Dall, U. S. N. M. XVII, p. 706.
845. *B. ovulum,* Dall, U. S. N. M. XVII, p. 707.
846. *B. viridum,* Dall, U. S. N. M. XII, p. 320.
847. *B. percrassum,* Dall, U. S. N. M. VIII, p. 216.
848. *B. plectrum,* Stimpson, Nautilus X, p. 18.
849. *B. castaneum,* Dall, U. S. N. M. XXIV, p. 519.
850. *B. tenellum,* Dall, U. S. N. M. XXIV, p. 519.
851. *B. picturum,* Dall, U. S. N. M. XXIV, p. 520.
852. *B. cyaneum* var. *morchianum,* Fischer, Nautilus X, p. 18.
853. *B. tenue,* Gray, Stimp. U. S. N. M. VIII, p. 215.
854. var. *elatior,* Midd, U. S. N. M. VIII, p. 215.
855. *B. fischeranum,* Morch, Nautilus XII, p. 111.

Genus, **Cantharus,** Bolten

856. *C. gemmatus,* Reeve, Nautilus V, p. 57.

Genus, **Beringius,** Dall

857. *B. aleuticus,* Dall, U. S. N. M. XVII, p. 711.
858. *B. frielei,* Dall, U. S. N. M. XVII, p. 711.
859. *B. crebricostatus,* Dall, U. S. N. M. XXIV, p. 530.
860. *B. kennicottii,* Dall, U. S. N. M. XXIV, p. 530.

Genus, **Strombella,** Gray

861. *S. callorhina,* Dall, U. S. N. M. VIII, p. 215.
862. *S. fragilis,* Dall, U. S. N. M. XIV, p. 187; XVII, p. 710.

863. *S. melonis,* Dall, U. S. N. M. XIV, p. 187; XVII, p. 710.
864. *S. middendorffii,* Dall, U. S. N. M. XIV, p. 186; XVII, p. 710.

Genus, **Tritonfusus,** Beck

865. *T. hallii,* Dall, U. S. N. M. XXIV, p. 525.
866. *T. brunnuem,* Dall, U. S. N. M. XXIV, p. 525.
867. *T. virens,* Dall, U. S. N. M. XXIV, p. 525.
868. *T. rectirostris,* Cpr., U. S. N. M. XXIV, p. 525.
869. *T. spitzbergensis,* Reeve, U. S. N. M. XXIV, p. 526.
870. *T. roseus,* Dall, U. S. N. M. XXIV, p. 526.
871. *T. martensi,* U. S. N. M. IX, p. 302; XXIV, p. 527.
872. *T. herendeeni,* Dall, U. S. N. M. XXIV, p. 527.

Genus, **Macron,** Adams

873. *M. kellettii,* A. Adams, S. I. Mis. Coll. No. 252, p. 150.
874. *M. lividus,* A. Adams, Figure 178.

Genus, **Volutopsius,** Morch.

875. *V. attenuatus,* Dall, U. S. N. M. XXIV, p. 529.
876. *V. castaneus,* Morch, U. S. N. M. XXIV, p. 528.
877. *V. kobelti,* Dall, U. S. N. M. XXIV, p. 528.
878. *V. regularis,* Dall, U. S. N. M. XXIV, p. 529.
879. *V. trophonius,* Dall, U. S. N. M. XXIV, p. 527.

Genus, **Liomesus,** Stimpson

880. *L. nux,* Dall, U. S. N. M. XXIV, p. 530.
881. *L. canaliculatus,* Dall, U. S. N. M. XXIV, p. 531.
882. *L. oöides,* Midd, U. S. N. M. XXIV, p. 531.
883. *L. nassula,* Dall, Nautilus XV, p. 89.

Family, NASSIDAE
Genus, **Nassa,** Lamarck

884. *N. californiana,* Conrad, Arnold, p. 231; U. S. N. M. XIV, p. 177.
885. *N. cooperi,* Forbes, Arnold, p. 234.
886. *N. fossata,* Gould, Figure 183.
887. *N. insculpta,* Cpr., U. S. N. M. XV, p. 212.
888. *N. mendica,* Gould, U. S. N. M. XIX, p. 377.
889. *N. perpinguis,* Hinds, U. S. N. M. XV, p. 213.
890. *N. tegula,* Reeve, Arnold, p. 235.

Family, COLUMBELLIDAE
Genus, **Columbella,** Lamarck

891. *C. aurantiaca,* Dall, U. S. N. M. XXIV, p. 531.
892. *C. carinata,* Hds., S. I. Mis. Coll. No. 252, p. 148.
893. *C. chrysalloidea,* Cpr., Arnold, p. 237.
894. *C. gausapata,* Gld., Figure 188.
895. *C. penicillata,* Cpr., U. S. N. M. XV, p. 213.
896. *C. tincta,* Cpr., small and rare, fide Oldroyd.
897. *C. tuberosa,* Cpr., Arnold, p. 240; U. S. N. M. XV, p. 213.
898. *C. permodesta,* Dall, U. S. N. M. XII, p. 327.
899. *C. baccata,* Gask., U. S. N. M. XV, p. 213.
900. *C. californiana,* Gaskoin, Arnold, p. 238; U. S. N. M. VIII, p. 215.

901. *C. rosacea,* Gould, U. S. N. M. VIII, p. 215.
902. *C. gouldii,* Cpr., Nautilus VII, p. 101.

Genus, **Anachis,** H. and A. Adams

903. *A. subturrita,* Cpr., S. I. Mis. Coll. No. 252, p. 150.

Genus, **Amphissa,** Adams

904. *A. bicolor,* Dall, U. S. N. M. XV, p. 213.
905. *A. corrugata,* Reeve, described in this book.
906. *A. undata,* Cpr., U. S. N. M. XV, p. 213.
907. *A. versicola,* Dall, Figure 191.

Family, MURICIDAE

Genus, **Murex,** Linne

908. *M. carpenteri,* Dall, Nautilus XII, p. 138.
909. *M. circumtextus,* Stearns, Figure 196.
910. *M. festivus,* Hinds, Figure 197.
911. *M. foliatus,* Martyn, Arnold, p. 245.
912. *M. gracillimus,* Stearns, U. S. N. M. XV, p. 215.
913. *M. incisus,* Brod, West Coast Shells, p. 22.
914. *M. nuttallii,* Conrad, S. I. Mis. Coll. No. 252, p. 149.
915. *M. petri,* Dall, Nautilus XIV, p. 37; U. S. N. M. XXIV, p. 532.
916. *M. trialatus,* Sby., Nautilus XIII, p. 29; Arnold, p. 243.
917. *M. painei,* Dall, Nautilus XVIII, p. 20.

Genus, **Muricidea,** Swainson

918. *M. santa-rosana,* Dall, Nautilus XIII, p. 29.

Genus, **Trophon,** Montfort

919. *T. triangulatus,* Cpr., Nautilus VII, p. 133; U. S. N. M. XXIV, p. 548.

920. *T. belcheri,* Hds., Nautilus VII, p. 133.

Genus, **Boreotrophon,** Fischer

921. *B. alaskanus,* Dall, U. S. N. M. XXIV, p. 545.
922. *B. avalonensis,* Dall, U. S. N. M. XXIV, p. 546.
923. *B. dalli,* Kobelt, U. S. N. M. XXIV, p. 548.
924. *B. beringi,* Dall, U. S. N. M. XXIV, p. 544.
925. *B. multicostatus,* Esch., Arnold, p. 251.
926. *B. tenuisculptus,* Cpr., U. S. N. M. XXIV, p. 541.
927. *B. scitulus,* Dall, U. S. N. M. XVII, p. 712.
928. *B. kamchatkanus,* Dall, U. S. N. M. XXIV, p. 541.
929. *B. orpheus,* Gould, U. S. N. M. XXIV, p. 542.
930. *B. stuarti,* E. A. Smith, U. S. N. M. XXIV, p. 542.
931. *B. smithi,* Dall, U. S. N. M. XXIV, p. 542.
932. *B. multicostatus,* Esch., U. S. N. M. XXIV, p. 543.
933. *B. pacificus,* Dall, U. S. N. M. XXIV, p. 544.
934. *B. disparilis,* Dall, U. S. N. M. XXIV, p. 545.
935. *B. tripherus,* Dall, U. S. N. M. XXIV, p. 545.
936. *B. eucymatus,* Dall, U. S. N. M. XXIV, p. 547.
937. *B. rotundatus,* Dall, U. S. N. M. XXIV, p. 547.
938. *B. cepula,* Sby., U. S. N. M. XXIV, p. 547.
939. *B. gracilis,* Perry, Arnold, p. 250.
940. *B. scalariformis,* Gld., Arnold, p. 252.

Genus, **Ocinebra,** Leach

941. *O. barbarensis,* Gabb, Arnold, p. 254.

942. *O. lurida,* Midd., Arnold, p. 257.
943. var. *munda,* Cpr., Arnold, p. 258.
944. *O. foveolata,* Hds., Nautilus XIII, p. 29.
945. *O. michaeli,* Ford, Pro. Phila. Acad. Sci. 1888, p. 188.
946. *O. subangulata,* Stearns, Nautilus XIII, p. 29.
947. *O. interfossa,* Cpr., Arnold, p. 255.
948. *O. perita,* Hds., Arnold, p. 259.
949. *O. poulsoni,* Nutt., Arnold, p. 260.

Genus, **Muricidea,** Swainson

950. *M. santa-rosana,* Dall, Nautilus XIII, p. 29.

Genus, **Urosalpinx,** Stimpson

951. *U. cinereus,* Say, Nautilus XII, p. 112.

Genus, **Cuma,** Humphrey

952. *C. muricata,* Hds., Catalina I., fide Oldroyd.

Genus, **Purpura,** Bruguiére

953. *P. crispata,* Chem., Figure 209.
954. *P. lima,* Mart., U. S. N. M. VIII, p. 215.
955. var. *emarginata,* Desh., U. S. N. M. XV., p. 214.
956. *P. biserialis,* Blainv., U. S. N. M. VIII, p. 535.
957. *P. saxicola,* Val., Nautilus XI, p. 81.
958. *P. ostrina,* Gould, U. S. N. M. XIX, p. 377.

Genus, **Monoceros,** Lamarck

959. *M. engonatum,* Conr., U. S. N. M. XV, p. 214.
960. var. *spiratum,* Blainv., U. S. N. M. XV, p. 214.
961. *M. lapelloides,* Conr., Figure 211.
962. *M. lugubre,* Sby., described in this book.

963. *M. paucilirata,* Stearns, U. S. N. M. VIII, p. 536.

Genus, **Sistrum,** Montfort

964. *S. carbonarium,* Say, southern fauna.

Sub-order, **STREPLODONTA**

Family, SCALARIDAE

Genus, **Scala,** Humphrey

965. *S. borealis,* Gould, Arnold, p. 266.
966. *S. crenatoides,* Cpr., U. S. N. M. XV, p. 210.
967. var. *insculpta,* Cpr., Arnold, p. 267.
968. *S. indianorum,* Cpr., Arnold, p. 264.
969. *S. tincta,* Cpr., Nautilus VII, p. 72.
970. *S. bellastriata,* Cpr., U. S. N. M. XV, p. 209.
971. *S. hindsii, Cpr.,* U. S. N. M. XV, p 209.
972. *S. occidentalis,* Nyst., U. S. N. M. XV., p. 210.
973. *S. retiporosa,* Cpr., U. S. N. M. XV, p. 210.
974. *S. crebricostata,* Cpr., Arnold, p. 263.
975. *S. grænlandicus,* Fabr., Nautilus V, p. 57.
976. *S. sawinæ,* Dall, Nautilus XVIII, p. 20.

Family, JANTHINIDAE

Genus, **Janthina,** Lamarck

977. *J. exigua,* Lam., U. S. N. M. XV, p. 210.

Family, EULIMIDAE

Genus, **Eulima,** Risso

978. *E. micans,* Cpr., Arnold, p. 269.
979. *E. rutila,* Cpr., S. I. Mis. Coll. No. 252, p. 145.
980. *E. thersites,* Cpr., S. I. Mis. Coll. No. 252, p. 145.

981. *E. distorta,* var. *yod,* S. I. Mis. Coll. No. 252. p. 39.
982. *E. incurva,* Ren., Bull. B. C. Nat. Hist. Soc. No. 1, p. 66.
983. *E. falcata,* Cpr., Nautilus X, p. 19.

Genus, **Eulimella,** Forbes

984. *E. occidentalis,* Hemphill, San Diego, Cal.

Family, PYRAMIDELLIDAE

Genus, **Obeliscus,** Humphrey

985. O. *variegatus,* Cpr., S. I. Mis. Coll. No. 252, p. 144.

Genus, **Turbonilla,** Leach

986. *T. aurantia,* Cpr., Arnold, p. 273.
987. *T. auricoma,* Dall & Bartsch, Arnold, p. 274.
988. *T. chocolata,* Cpr., Bull. 1, B. C. Nat. Hist. Soc., p. 65.
989. *T. laminata,* Cpr., fide Bartsch.
990. *T. torquata,* Gld., Nautilus X, p. 20.
991. *T. tridentata,* Cooper, Nautilus X, p. 20.
992. *T. pentalopha,* D. & B., Arnold, p. 274.
993. *T. tenuicula,* Gld., Arnold, p. 275.
994. *T. lowei,* D. & B., Arnold, p. 278.
994*a*. var. *pedroana,* D. & B., Arnold, p. 279.
995. *T. gibbosa,* Cpr., Arnold, p. 279.
996. *T. lordi,* E. A. Smith, Nautilus VII, p. 102.
997. *T. stylina,* Cpr., Nautilus X, p. 20.
998. *T. latifundia,* D. & B., San Pedro, fide Oldroyd.
999. *T. eucosniobasis,* D. & B., San Pedro, fide Oldroyd.
1000. *T. castanea,* Cpr., West Coast Shells, p. 52.

Genus, **Odostomia,** Fleming

1001. *O. gouldii,* Cpr., Arnold, p. 282.
1002. *O. gravida,* Cpr., Nautilus V, p. 57.
1003. *O. inflata,* Cpr., B. C. Bull. 1, p. 65.
1004. *O. nuciformis,* Cpr., Arnold, p. 283.
1005. *O. satura,* B. C. Bull. 1, p. 65.
1006. *O. straminea,* Cpr., B. C. Bull. 1, p. 65.
1007. *O. tenuisculpta,* Cpr., B. C. Bull. 1, p. 65.
1008. *O. sitkensis,* Dall, B. C. Bull. 1, p. 65.
1009. *O. tenuis,* Cpr., Nautilus X, p. 19.
1010. *O. pupiformis,* Cpr., Arnold, p. 283.
1011. *O. aequisculpta,* Cpr., Arnold, p. 284.
1012. *O. cincta,* Cpr., Nautilus X, p. 19.
1013. *O. helga,* Dall & Bartsch.
1014. *O. americana,* D. & B., Pro. Bio. Soc. of Wash. XVII, p. 16.
1015. *O. virginalis,* Dall & Bartsch.
1016. *O. subplanata,* Cpr., B. C. Bull. 2, p. 14.
1017. *O. kennerleyi,* D. & B., San Pedro, fide Oldroyd.
1018. *O. (Odontostomia) inflecta* (Cpr.), Dall, B. C. Bull. 2, p. 14.

Genus, **Chrysallida,** Carpenter

1019. *C. communis,* C. B. Adams, Nautilus XIII, p. 28.

Genus, **Miralda,** A. Adams

1020. *M. quinquecincta,* Cpr., West Coast Shells, p. 52.

Genus, **Mumiola,** A. Adams

1021. *M. tenuis,* Dall, Nautilus X, p. 19.

Genus, **Oscilla,** A. Adams

1022. *O. insculpta,* Cpr., West Coast Shells, p. 52.
Family, TRITONIIDAE
Genus, **Tritonium,** Link.

1023. *T. gibbosum,* Brod., Nautilus VII, p. 75; Arnold, p. 286.
Genus, **Priene,** H. & A. Adams

1024. *P.oregonensis,* Redf., Arnold, p. 286.
Genus, **Gyrineum,** Link

1025. *G. californicum,* Hds., Nautilus XVII, p. 108.
Family, CYPRAEIDAE
Genus, **Pedicularia,** Swainson

1026. *P. californica,* Newc., U. S. N. M. XXIV, p. 550.
Genus, **Cypraea,** Linne

1027. *C. spadicea,* Gray, Nautilus IV, p. 54.

1028. *C. sowerbyi,* Kien., San Diego, fide Oldroyd.
Genus, **Trivia,** Gray

1029. *T. californica,* Gray, Figure 223.

1030. *T. solandri,* Gray, Nautilus VII, p. 133.

1031. *T. ritteri,* Raymond, Nautilus XVIII, p. 20.
Genus, **Ovula,** Bruguière

1032. *O. deflexia,* var. *barbarense,* Dall, Nautilus XV, p. 206.
Genus, **Erato,** Risso

1033. *E. columbella,* Menke, S. I. Mis. Coll. 252, p. 143.

1034. *E. vitellina,* Hds., S. I. Mis. Coll. 252, p. 143.
Family, TRIFORIDAE
Genus, **Triforis,** Deshayes

1035. *T. adversa,* Montagu, Arnold, p. 290.
Family, CERITHIOPSIDAE
Genus, **Cerithiopsis,** Forbes & Hanley
1036. *C. assimilata,* C. B. Adams, Arnold, p. 290.
1037. *C. columna,* Cpr., B. C. Bull. 1, p. 66.
1038. *C. tuberculata,* Mont., B. C. Bull. 1, p. 66.
1039. *C. munita,* Cpr., B. C. Bull. 1, p. 66.
1040. *C. truncata,* Dall, U. S. N. M. IX, p. 304.
1041. *C. fortior,* Cpr., U. S. N. M. XV, p. 210.
1042. *C. purpurea,* Cpr., U. S. N. M. XV, p. 210.
1043. *C. stejnegeri,* Dall, U. S. N. M. VIII, p. 212.
Family, CERITHIIDAE
Genus, **Cerithidea,** Swainson
1044. *C. californica,* Hald., Arnold, p. 296.
Genus, **Vertagus,** Klein
1045. *V. lordi,* Yates, Nautilus V, p. 24.
Genus, **Bittium,** Leach
1046. *B. armillatum,* Cpr., S. I. No. 252, p. 141.
1047. *B. asperum,* Cpr., S. I. No. 252, p. 141.
1048. *B. filosum,* Gld., S. I. No. 252, p. 141.
1049. var. *esuriens,* Cpr., S. I. No. 252, p. 141.
1050. *B. attenuatum,* Cpr., S. I. No. 252, p. 141.
1051. *B. fastigiatum,* Cpr., S. I. No. 252, p. 141.
1052. *B. quadrifilatum,* Cpr., Nautilus X, p. 18.
1053. *B. williamsoni,* Arnold, Arnold, p. 295.
1054. *B. tenuisculpta,* Cpr., Arnold, p. 296.
1055. *B. californicum,* Dall & Bartsch, Nautilus XV, p. 58.
1056. *B. rugatum,* Cpr., Arnold, p. 295.
1057. *B. subplanatum,* Cpr., fide Oldroyd.
Family, TRICHOTROPIDAE
Genus, **Trichotropis,** Sby.

1058. *T. borealis,* Br. & Sby., Nautilus X, p. 20.
1059. *T. cancellata,* Hds., B. C. Bull. 1, p. 67.

Genus, **Anaplocamus,** Dall

1060. *A. borealis,* Dall, U. S. N. M. XXIV, p. 550.

Family, CAECIDAE

Genus, **Caecum,** Fleming

1061. *C. californicum,* Dall, U. S. N. M. VIII, p. 541.
1062. *C. crebricinctum,* Cpr., Nautilus X, p. 18.
1063. *C. orcutti,* Dall, U. S. N. M. VIII, p. 541.

Family, VERMETIDAE

Genus, **Vermetus,** Adanson

1064. *V. lituella,* Mörch., described in this book.
1065. *V. squamigerus,* Cpr., Arnold, p. 299.
1066. *V. annellum,* Cpr., Man. Conch. VIII, p. 193.
1067. *V. fewkesi,* Yates, Nautilus V, p. 24.

Genus, **Bivonia,** Gray

1068. *B. compacta,* Cpr., U. S. N. M. XV, p. 204.

Family, TURRITELLIDAE

Genus, **Turritella,** Lamarck

1069. *T. cooperi,* Cpr., Nautilus VII, p. 133.
1070. *T. goniostoma,* Val., U. S. N. M. XIX, p. 378.
1071. *T. lacteola,* Cpr., U. S. N. M. XV, p. 205.
1072. *T. (Mesalia) tenuisculpta,* Cpr., W. C. S., p. 73.
1073. *T. erosa,* Couth, U. S. N. M. VIII, p. 212.
1074. *T. (Mesalia) reticulata,* Migh., Nautilus VII, p. 101.

Family, LITTORINIDAE

Genus, **Littorina,** Ferrussac

1075. *L. planaxis,* Nutt., U. S. N. M. XV, p. 205.
1076. *L. scutulata,* Gld., U. S. N. M. XV, p. 205.
1077. var. *plena,* Gld., U. S. N. M. XV, p. 205.
1078. *L. pullata,* Cpr., S. I. Mis. Coll. 252, p. 105.
1079. *L. rudis,* Don., described in this book.
1080. *L. aleutica,* Dall, U. S. N. M. XXIV, p. 551.
1081. *L. atkana,* Dall, U. S. N. M. XXIV, p. 551.
1082. *L. sitchana,* Phil., U. S. N. M. XXIV, p. 551.

Genus, **Lacuna,** Turton

1083. *L. compacta,* Cpr., Arnold, p. 302.
1084. *L. porrecta,* Cpr., Arnold, p. 303.
1085. *L. solidula* (Lov.), Cpr., Arnold, p. 303.
1086. *L. unifasciata,* Cpr., Figure 236.
1087. *L. vincta,* Montagu, B. C. Bull. 1, p. 63.
1088. *L. variegata,* Cpr., B. C. Bull. 1, p. 63.

Family, FOSSARIDAE

Genus, **Fossarus,** Philippi

1089. *F. (Isapis) fenestratus,* Cpr., S. I. Mis. Coll. 252, p. 142.
1090. *F. obtusus,* Cpr., S. I. Mis. Coll. 252, p. 142.

Family, LITIOPIDAE

Genus, **Diala,** A. Adams

1091. *D. acuta,* Cpr., S. I. Mis. Coll. 252, p. 143.
1092. *D. marmorea,* Cpr., Nautilus X, p. 18.

Family, STREPOMATIDAE

Genus, **Goniobasis,** Lea

1093. *G. acutifilosa,* Stearns, U. S. N. M. XIII, p. 211.

1094. var. *siskiyouensis,* Pilsbry, Nautilus XIII, p. 65.
1095. *G. bulbosa,* Gld., Nautilus XIII, p. 65.
1096. *G. rubiginosa,* Lea, Nautilus XIII, p. 65.
1097. *G. nigrina,* Lea, Nautilus IV, p. 87.
1098. var. *draytonii,* Lea, Nautilus XIII, p. 66.
1099. *G. occata,* Hds., Nautilus XIII, p. 65.
1100. *G. plicifera,* Lea, Nautilus XIII, p. 65.
1101. *G. circumlineata,* Tryon, Nautilus XIII, p. 65.

Family, RISSOELLIDAE

Genus, **Jeffreysia,** Alder

1102. *J. alderii,* Cpr., S. I. Mis. Coll. 252, p. 143.
1103. *J. translucens,* Cpr., U. S. N. M. XV, p. 206.

Family, RISSOIDAE

Genus, **Rissoa,** Fréminville

1104. *R. acutelirata,* Cpr., Arnold, p. 305.
1105. *R. reticulata,* Cpr., U. S. N. M. XV, p. 206.
1106. *R. castanea,* Moll., B. C. Bull. 1, p. 63.
1107. *R. compacta,* Cpr., B. C. Bull. 1, p. 63.
1108. *R. filosa,* Cpr., B. C. Bull. 1, p. 63.
1109. *R. kelseyi,* Dall & Bartsch, Nautilus XVI, p. 94.

Genus, **Onoba,** H. & A. Adams

1110. *O. aleutica,* Dall, U. S. N. M. IX, p. 307.
1111. *O. cerinella,* Dall, U. S. N. M. IX, p. 307.
1112. *O. saxitalis,* Möll., U. S. N. M. IX, p. 306.

Genus, **Bithinella,** Moquin-Tandon

1113. *B. binneyi,* Tryon, U. S. N. M. VIII, p. 541.
1114. *B. intermedia,* Tryon, U. S. N. M. VIII, p. 541.

1115. *B. hemphilli,* Pilsbry, Nautilus IV, p. 63.

Genus, **Paludestrina,** d'Orbigny

1116. *P. longinqua,* Gould, Nautilus XII, p. 122.
1117. *P. imitator,* Pilsbry, Nautilus XII, p. 124.
1118. *P. hemphilli,* Pilsbry, Nautilus XII, p. 124.
1119. *P. protea,* Gould, Nautilus XII, p. 122.
1120. *P. stearnsiana,* Pilsbry, Nautilus XII, p. 124.

Genus, **Cingula,** Fleming

1121. *C. robusta,* Dall, U. S. N. M. IX, p. 306.

Genus, **Barleeia,** Clark

1122. *B. haliotophila,* Cpr., B. C. Bull. 1, p. 63.
1123. *B. subtenuis,* Cpr., S. I. Mis. Coll. 252, p. 142.

Genus, **Rissoina,** d'Orbigny

1124. *R. interfossa,* Cpr., S. I. Mis. Coll. 252, p. 142.
1125. *R. newcombei,* Dall, B. C. Bull. 2, p. 14.
1126. *R. bakeri,* Bartsch, Nautilus XVI, p. 9.

Genus, **Alvania,** Risso

1127. *A. aequisculpta,* Cpr., West Coast Shells, p. 65.
1128. *A. castanea,* Moll., U. S. N. M. IX, p. 307.
1129. *A. castanella,* Dall, U. S. N. M. IX, p. 307.
1130. *A. aurivillii,* Dall, U. S. N. M. IX, p. 308.

Genus, **Fluminicola,** Stimpson

1131. *F. nuttalliana,* Lea, Nautilus XII, p. 123.
1132. *F. fusca,* Hald., Nautilus XII, p. 123.
1133. *F. virens,* Lea, Nautilus XII, p. 123.
1134. *F. seminalis,* Hinds, Nautilus XII, p. 123.
1135. var. *dalli,* Call, Nautilus XII, p. 123.

1136. *F. merrimani,* Pils. & Beecher, Nautilus V, p. 143.

1137. *F. columbiana,* Hempl., Nautilus XII, p. 125.

1138. *F. erythropoma,* Pilsbry, Nautilus XII, p. 125.

Genus, **Tryonia,** Stimpson

1139. *T. clathrata,* Stimp., Nautilus XII, p. 122.

Genus, **Amnicola,** Gld. & Hald.

1140. *A. cincinnatensis,* Anth., Nautilus XII, p. 122.

1141. *A. limosa,* Say, Nautilus XII, p. 122.

1142. *A. micrococcus,* Pilsbry, Nautilus XII, p. 121.

Genus, **Pyrgulopsis,** Call and Pilsbry

1143. *P. navadensis,* Stearns, Pro. Davenport Acad. Nat. Sci. 1886, Vol. V, p. 10.

Genus, **Pomatiopsis,** Tryon

1144. *P. binneyi,* Tryon, Nautilus XII, p. 123.

1145. *P. californica,* Pilsbry, Nautilus XII, p. 126.

Genus, **Valvata,** Muller

1146. *V. sincera,* Say, Nautilus IX, p. 102.

1147. *V. utahensis,* Call, Nautilus XV, p. 125.

1148. *V. virens,* Tryon, Nautilus XIII, p. 67.

Family, ASSIMINEIDAE

Genus, **Assiminea,** Leach

1149. *A. californica,* Cooper, Nautilus V, p. 57.

1150. *A. subrotundata,* Cpr., B. C. Bull. 1, p. 63.

Genus, **Paludinella,** Lowe

1151. *P. newcombiana,* Hempl., described in this book.

Genus, **Truncatella,** Risso

1152. *T. californica,* Pfr., described in this book.

1153. *T. stimpsoni,* Stearns, U. S. N. M. VIII, p. 541.

Family, PALUDINIDAE

Genus, **Paludina,** Lamarck

1154. *P. japonica,* Mart., Nautilus V, p. 114.

Genus, **Vivipara,** Montfort

1155. *V. stelmaphora,* Bgt., Nautilus XV, p. 91.

Family, CALYPTRAEIDAE

Genus, **Crucibulum,** Schumacher

1156. *C. spinosum,* Sby., Figure 243.

1157. *C. imbricatum,* Brod., U. S. N. M. XV, p. 203.

Genus, **Calyptraea,** Lamarck

1158. *C. mamillaris,* Brod., described in this book.

Genus, **Crepidula,** Lamarck

1159. *C. aculeata,* Gmel., Arnold, p. 308.

1160. *C. adunca,* Sby., Figure 244.

1161. *C. dorsata,* Brod., S. I. No. 252, p. 140.

1162. *C. navicelloides,* Nutt., S. I. No. 252, p. 140.

1163. *C. onyx, Sby.,* S. I. No. 252, p. 140.

1164. *C. rugosa,* Nutt., S. I. No. 252, p. 140.

1165. *C. navicelloides,* Nutt., Figure 245.

1166. *C. convexa,* var. *glauca,* Say, Nautilus XIII, p. 8.

1167. *C. excavata,* Brod., U. S. N. M. XV, p. 203.

1168. *C. explanata,* Gould, U. S. N. M. XV, p. 203.

1169. *C. grandis,* Midd., Arnold, p. 309.

1170. *C. lessonii,* Brod., described in this book.

Family, CAPULIDAE

Genus, **Capulus,** Montfort

1171. *C. californicus,* Dall, Nautilus XIII, p. 100.

Family, AMALTHEIDAE

Genus, **Amalthea,** Schumacher

1172. *A. antiquatus,* Linné, Figure 246.

1173. *A. cranioides,* Cpr., Arnold, p. 312.

1174. *A. serratus,* Cpr., S. I. No. 252, p. 140.

1175. *A. tumens,* Cpr., S. I. No. 252, p. 140.

Family, NATICIDAE

Genus, **Natica,** Lamarck

1176. *N. clausa,* Brod. & Sby., B. C. Bull. 1, p. 67.

1177. *N. russa,* Gld., San Pedro, fide Oldroyd.

Genus, **Lunatia,** Gray

1178. *L. draconis,* Dall, Nautilus XVII, p. 132.

Genus, **Polinices,** Montfort

1179. *P. lewissii,* Gld., Figure 247.

1180. *P. recluziana,* Desh., Arnold, p. 314.

Genus, **Amauropsis,** Mch.

1181. *A. purpurea,* Dall, U. S. N. M. XXIV, p. 551.

Genus, **Sigaretus,** Lamarck

1182. *S. debilis,* Gld., U. S. N. M. XV, p. 211.

Genus, **Eunaticina,** Fischer

1183. *E. oldroydii,* Dall, Nautilus XI, p. 85; XIII, p. 85.

Genus, **Velutina,** Fleming

1184. *V. conica,* Dall, U. S. N. M. IX, p. 305.

1185. *V. laevigata,* Linné, Nautilus VII, p. 101.

1186. *V. prolongata,* Cpr., B. C. Bull. 1, p. 68.
1187. *V. cryptospira,* Midd., U. S. N. M. VIII, p. 211.

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1188. *L. diegoensis,* Dall, U. S. N. M. VIII, pp. 534 and 538.
1189. *L. stearnsii,* Dall, Arnold, p. 317.

Genus, **Lepeta,** Gray

1190. *L. concentrica,* Midd., Nautilus X, p. 69.

Family, ACMAEIDAE
Genus, **Acmaea,** Eschscholtz

1191. *A. asmi,* Midd., S. I. Mis. Coll. 252, p. 136.
1192. *A. depicta,* Hds., Nautilus VII, p. 76.
1193. *A. incessa,* Hds., Figure 258.
1194. *A. instabilis,* Gld., Arnold, p. 318.
1195. *A. mitra,* Esch., Figure 257.
1196. *A. paleaca,* Gld., Nautilus VII, p. 76.
1197. *A. patina,* Esch., S. I. No. 252, p. 136.
1198. *A. pelta,* Esch., S. I. No. 252, p. 136.
1199. *A. persona,* Esch., Nautilus V, p. 57.
1200. var. *umbonata,* Nutt., S. I. No. 252, p. 136.
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1202. *A. spectrum,* Figure 252.
1203. *A. fenestrata,* Nutt., Nautilus V, p. 94.
1204. *A. triangularis,* Cpr., S. I. No. 252, p. 136.
1205. *A. peramabilis,* Dall, Bull. U. S. N. M. 1, p. 123.
1206. *A. sybaritica,* Dall, Bull. U. S. N. M. 1, p. 123.
1207. *A. apicina,* Dall, Bull. U. S. N. M. 1, p. 123.

1208. *A. digitalis,* Esch., Nautilus X, p. 69.
1209. *A. cumingii,* Rve., Nautilus V, p. 57.
1210. *A. rosacea,* Cp., S. I. Mis. Coll. 252, p. 136.

Genus, **Lottia,** Gray

1211. *L. gigantea,* Gray, S. I. Mis. Coll. 252, p. 136.

Family, PHASIANELLIDAE

Genus, **Phasianella,** Lamarck

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1213. *P. pulloides,* Cpr., Nautilus X, p. 19.
1214. *P. lurida,* Dall, Nautilus X, p. 19.

Genus, **Eucosmia,** Carpenter

1215. *E. substriata,* Cpr., B. C. Bull. 2, p. 15.

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1216. *P. undosus,* Wood, U. S. N. M. XV, p. 199.

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1228. *C. supragranosum,* Cpr., U. S. N. M. XV, p. 201.
1229. *C. tricolor,* Gabb, Figure 270.
1230. *C. turbinum,* Dall, U. S. N. M. XVIII, p. 8; XXIV, p. 552.
1231. *C. platinum,* Dall, U. S. N. M. XII, p. 343.
1232. *C. versicolor,* Mke., U. S. N. M. XV, p. 201.
1233. *C. variegatum,* Cpr., U. S. N. M. XXIV, p. 552.

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1234. *T. caffea,* Gabb, Arnold, p. 327.

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1236. *M. lirulata,* Cpr., U. S. N. M. XV, p. 201.
1237. *M. pupilla,* Gld., Nautilus VII, p. 101.
1238. *M. beringensis,* Smith, northern; Seal Rep.
1239. *M. albolineata,* Smith, northern; Seal Rep.
1240. *M. albula,* Gld., Nautilus XII, p. 111.

Genus, **Margarites,** Dall

1241. *M. vorticiferus,* Dall, U. S. N. M. XXIV, p. 554.

Genus, **Chlorostoma,** Swainson

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1248. var. *tincta,* Hmp., U. S. N. M. XV, p. 200.
1249. *C. montereyi,* Kien., Arnold, p. 326.
1250. *C. viridulum,* var. *ligulatum,* Mke., Arnold, p. 327.
1251. *C. pulligo,* Mart., Arnold, p. 328.
1252. *C. globulus,* Cpr., U. S. N. M. XV, p. 200.

Genus, **Solariella,** A. Adams

1253. *S. cidaris,* A. Ad., Arnold, p. 334.
1254. *S. peramabilis,* Cpr., Nautilus VII, p. 102.
1255. *S. oxybasis,* Dall, U. S. N. M. XII, p. 352.
1256. *S. carlotta,* Dall, N. M. XXIV, p. 553.
1257. *S. varicosa,* Migh. & Ad., Nautilus VII, p. 102.

Genus, **Halistylus,** Dall

1258. *H. pupoideus,* Dall, Nautilus X, p. 19.

Genus, **Turcicula,** Dall

1259. *T. bairdii,* Dall, U. S. N. M. XIII, p. 346.

Genus, **Gibbula,** Risso

1260. *G. canfieldii,* Dall, N. M. XV, p. 201.

Family, DELPHINULIDAE

Genus, **Liotia,** Gray

1261. *L. acuticostata,* Cpr., N. M. XV, p. 199.
1262. *L. fenestrata,* Cpr., West Coast Shells, p. 86.

Genus, **Molleria,** Jeffreys

1263. *M. quadræ,* Dall, B. C. Bull. 2, p. 15.

Family, CYCLOSTREMATIDAE

Genus, **Vitrinella,** C. B. Adams

1264. *V. williamsoni,* Dall, U. S. N. M. XV, p. 202.
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Genus, **Haliotis,** Linné
1265. *H. assimilis,* Dall, Nautilus IX, p. 131.
1266. *H. corrugata,* Gray, Nautilus IX, p. 131.
1267. *H. cracherodii,* Leach, Nautilus IX, p. 103.
1268. *H. fulgens,* Phil., N. M. XXII, p. 139.
1269. var. *walallensis,* Stearns, Nautilus XII, p. 106.
1270. *H. gigantea,* Chem., Nautilus IX, p. 132.
1271. *H. rufescens,* Swains., Nautilus XVI, p. 84.
Genus, **Schismope,** Jeffreys
1272. *S. rimuloides,* Cpr., Nautilus XVII, p. 84.
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Genus, **Puncturella,** Lowe
1273. *P. cooperi,* Cpr., Nautilus V, p. 106.
1274. *P. cuculata,* Gld., Arnold, p. 341.
1275. *P. major,* Dall, N. M. XIV, p. 189.
1276. *P. galeata,* Gld., Arnold, p. 341.
Genus, **Emarginula,** Lamarck
1277. *E. crassa,* J. Sby., B. C. Bull. 1, p. 59.
1278. *E. bella,* Gabb, Nautilus V, p. 106.
Genus, **Subemarginula,** Blainville
1279. *S. yatesii,* Dall, Nautilus XIV, p. 125.
Genus, **Fissurella,** Bruguiére
1280. *F. volcano,* Rve., Arnold, p. 340.
Genus, **Fissuridea,** Swainson
1281. *F. aspera,* Esch., Nautilus V, p. 105.
1282. *F. murina,* Dall, Arnold, p. 339.
1283. *F. rugosa,* Sby., U. S. N. M. XV, p. 198.
Genus, **Lucapina,** Gray

1284. *L. crenulata,* Sby., Nautilus XV, p. 71.
Genus, **Lucapinella,** Pilsbry

1285. *L. callomarginata,* Cpr., Arnold, p. 340; Nautilus IV, p. 96.
Genus, **Megatebennus,** Pilsbry

1286. *M. bimaculatus,* Dall, Arnold, p. 339.
Order, **POLYPLACOPHORA**
Super-family, EOPLACOPHORA
Family, LEPIDOPLEURIDAE
Genus, **Lepidopleurus,** Risso

1287. *L. ambustus,* Dall, Santa Barbara (dredged).

1288. *L. cancellatus,* Sby., Arctic Sea to Sitka.

1289. *L. internexus,* Cpr., Santa Barbara, etc.

1290. *L. nexus,* Cpr., Catalina Is.

1291. *L. rugatus,* Cpr., Monterey southward.

1292. *L. (Oldroydia) percrassus,* Dall, S. Cal.
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Family, ISCHNOCHITONIDAE
Sub-family, ISCHNOCHITONINAE
Genus, **Tonicella,** Carpenter

1293. *T marmorea,* Fabr., Aleutian Islands.

1294. *T. submarmorea,* Midd., Japan; Aleutian Is. to Sts. Fuca.

1295. *T. lineata,* Wood, Bering Sts. to Monterey.

1296. *T. saccharina,* Dall, Aleutian and Shumagin Is.

1297. *T. sitkensis,* Dall, Sitka.
Genus, **Schizoplax,** Dall

1298. *S. brandti,* Midd., Okhotsk Sea, Sitka.
Genus, **Trachydermon,** Carpenter

1299. *T. albus,* L., Arctic to Shumagin Is.
1300. *T. dentiens,* Gld., Puget Sound; San Diego.
1301. *T. gothicus,* Cpr., Catalina Is.
1302. *T. flectens,* Cpr., Puget Sound.
1303. *T. lividus,* Midd., Sitka.
1304. *T. scrobiculatus,* Midd., "California."
1305. *T. ruber,* L., Arctic to Sitka.
1306. *T. (Trachyradsia) aleuticus,* Dall, Aleutian Is.
1307. *T. (Cyanoplax) hartwegi,* Cpr., Vancouver Is. to Magdalena Bay.
1308. var. *nuttalli,* Cpr.
1309. *T. raymondi,* Pils., Puget Sound to Monterey.

Genus, **Chaetopleura,** Shuttleworth

1310. *C. gemmea,* Cpr., Monterey.
1311. *C. livida,* Sby., West British Columbia.
1312. var. *parallela,* Cpr., to Cape St. Lucas.
1313. var. *prasinata,* Cpr., to Cape St. Lucas.

Genus, **Pallochiton,** Dall

1314. *P. lanuginosus,* Cpr., San Diego southward.

Genus, **Ischnochiton,** Gray

1315. *I. fallax,* Cpr., Monterey.
1316. *I. magdalenensis,* Hds., Monterey southward.
1317. *I. conspicuus,* Cpr., Santa Barbara southward.
1318. var. *solidus,* Cpr., Carpinteria, etc.
1319. *I. interstinctus,* Gld., Sitka to Monterey; S. B. Is.
1320. *I. newcombi,* Cpr., Catalina Is.

1321. *I. radians,* Cpr., Monterey, Pt. San Pedro.
1322. *I. scabricostatus,* Cpr., Catalina Is.
1323. *I. reteporosus,* Cpr., San Pedro, Victoria.
1324. *I. veredentiens,* Cpr., Catalina Is.
1325. *I. aureotinctus,* Cpr., Catalina Is.
1326. *I. decipiens,* Cpr., Monterey.
1327. *I. corrugatus,* Cpr., Catalina Is.
1328. *I. mertensii,* Midd., Sitka to Monterey.
1329. *I. cooperi,* Cpr., Bolinas to Santa Cruz.
1330. *I. clathratus,* Rve., Monterey to La Paz.
1331. *I. sinudentatus,* Cpr., Monterey.
1332. *I. regularis,* Cpr., Monterey.
1333. *I. trifidus,* Cpr., Sitka to Puget Sound.

Subfamily, CALLISTOPLACINAE

Genus, **Callistochiton,** Cpr.

1334. *C. palmulatus,* Cpr., Monterey; Sta. Barbara.
1335. var. *mirabilis,* Pils., San Diego.
1336. *C. crassicostatus,* Pils., Monterey.

Genus, **Nuttallina,** Carpenter

1337. *N. californica,* Nutt., Vancouver Is. to Pt. Conception.
1338. *N. scabra,* Rve., Pt. Conception southward.
1339. *N. thomasi,* Pilsbry.

Family, MOPALIDAE

Genus, **Mopalia,** Gray

1340. *M. muscosa,* Gld., Shumagin Is. to San Diego.
1341. var. *porifera,* Pils., Bolinas and S. F.
1342. var. *acuta,* Cpr., Sta. Barbara, San Diego.

1343. *M. hindsi* (Sby) Rve., Middle California.
1344. *M. lignosa,* Gld., Van. Is. to Monterey.
1345. *M. imporcata,* Cpr., Puget Sound; Santa Barbara.
1346. *M. sinuata,* Cpr., Puget Sound; S. F.
1347. *M. ciliata,* Sby., Aleutian Is. to Monterey.
1348. var. *wossnessenski,* Midd., Sitka to Wash.
1349. *M. heathi,* Pilsbry.

Genus, **Placiphorella,** Carpenter

1350. *P. velata,* Cpr., Humboldt Bay to Lower California.
1351. *P. borealis,* Pils., Bering Sea.

Family, ACANTHOCHITIDAE
Genus, **Acanthochites,** Risso.

1352. *A. avicula,* Cpr., Catalina Is.
1353. var. *diegoensis,* Pils., San Diego.

Genus, **Katherina,** Gray

1354. *K. tunicata,* Wood, N. Pacific to Catalina Is.

Genus, **Amicula,** Gray

1355. *A. vestita,* Sby., Arctic to St. Paul.
1356. *A. pallasii,* Midd., Aleutian Is., etc.

Genus, **Cryptochiton,** Gray

1357. *C. stelleri,* Midd., Aleutian Is. to Sta. Barbara Islands.

Class, CEPHALOPODA
Family, ARGONAUTIDAE
Genus, **Argonauta,** Linné

1358. *A. pacifica,* Dall, U. S. N. M. XV, p. 217.

Family, OCTOPODIDAE
Genus, **Octopus,** d'Orbigny

1359. *O. punctatus,* Gabb, Pro. Cal. Acad. Sci., 1862, p. 170.

Subfamily, OMMASTREPHIDAE

Genus, **Ommastrephes,** d'Orb.

1360. *O. gigas,* d'Orb., Hoyle's Cat., p. 38.

1361. *O. tryonii,* Gabb, Hoyle's Cat., p. 39.

Subfamily, ONYCHOTEUTHIDAE

Genus, **Onychoteuthis,** Licht.

1362. *O. fusiformis,* Gabb, Pro. Cal. Acad. Sci., 1862, p. 171.

1363. *Macromphalina californica,* Dall, Nautilus XVIII, p. 19.

1364. *Ashmunella townsendi,* Bartsch, Smithsonian Mis. Coll. (Quarterly Issue), Vol. 47, p. 13.

1365. *Pyramidula asteriscus,* Morse, p. 122.

1366. *Pyramidula lineatus,* Say, p. 122.

1367. *Scaphella arnheimi,* Rivers, Nautilus V, p. 111.

1368. *S. stearnsii,* Dall, U. S. N. M. XXIV, p. 517.

1369. *Seila assimilis,* C. B. Adams, p. 211.

1370. *Ashmunella walkeri,* Ferriss, Nautilus XVIII, p. 53.

1371. *Oreohelix* clappi, Ferriss, Nautilus XVIII, p. 53.

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